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Review of existing protocols and standards applicable to the exploitation of deep-sea mineral resources

Deliverable 8.2

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10 December 2015
Review of existing protocols and standards applicable to the exploitation of deep-sea mineral resources

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Review of existing protocols and standards applicable to the exploitation of deep-sea mineral resources

Introduction
To date there has been no deep-sea mining, yet the sector already faces challenges in obtaining support and approval for developments. In some cases societal concerns have stopped planned mining projects (New Zealand Environmental Protection Authority 2014, 2015). Perceptions about the likely environmental impacts of deep-sea mining have been determined largely from impacts caused by allied industries, such as offshore oil and gas operations and terrestrial mining. The social and environmental effects of mining on land feature regularly in the media (e.g. The Guardian, UK, 1 August 2015 (Vidal 2015)). The mines, refineries and waste tailings have the potential to cause large-scale localized impacts, contaminating water supplies, damaging crops and affecting human health. If these incidents were infrequent and isolated, perhaps they would pass unnoticed, but the cumulative effect of recurring incidents in many different localities around the world indicates that local management of mining could be improved considerably. The mining industry as a whole has a tarnished image, which affects operators with good and poor management records alike. Reputation and financial risks can cause significant damage to the prospects of companies working in the offshore environment, such as >20 billion dollar financial impact of the 2010 Deep Water Horizon oil spill in the Gulf of Mexico to BP. For many companies, therefore, corporate responsibility is a key issue in order to sustain a profitable business. Maximizing the long-term prospects of the deep-sea mining industry as it develops is important not just for individual companies, but for the deep-sea mining sector as a whole.

The deep-sea mining industry must demonstrate transparently its commitment to environmental sustainability in order to obtain and keep its societal license to operate. It must comply with existing legislation, follow best-practice guidance, learn from the experience of allied industries and take all steps to minimize environmental impacts. To do this effectively the industry needs to develop and maintain high standards of operations throughout the development cycle. Such management of processes are not straightforward and rely on developing, documenting, reviewing and refining activities through protocols and standards.

Protocols can be defined as a series of prescribed steps to be taken, usually in order, to allow for the coordinated action of multiple parties, typically within one organisation. Standards are agreed ways of doing the work. Standards may include formalised protocols
that have been accepted by different groups. The approval of standards by several, or many, different organisations is the difference between the two terms. Standards are important in achieving consistency between organisations. In many cases standardization may be formalized, particularly for international standards. Standards may be adopted at several levels, from groups of operators, to bodies representing industry sectors, to international organisations, such as the International Organization for Standardization (ISO). Most standards are developed only on request by a stakeholder group to respond to a need in the market. For ISO standards, global groups of experts are assembled to form technical committees, which may include a range of stakeholders. The groups negotiate all aspects of the standard, including its scope, key definitions and content. Developing ISO standards is a consensus-based approach; comments from stakeholders are taken into account through a number of review stages. The standard is adopted and published if accepted by the majority of the technical committee and ISO members.

Standards and protocols bring technological, economic, environmental and societal benefits. By helping to harmonize services and activities to a consistent and recognized level, they increase environmental and social sustainability and make industry more efficient and safe. As standards draw on international expertise and experience, they are an important resource for governments when developing policy. Standards may be either incorporated directly into policy, including a requirement for certification, or specific elements can be enshrined in regulations and laws. There are many benefits of standardization for environmental management (Table 1).
### Table 1: Benefits of protocols and standards for environmental management

<table>
<thead>
<tr>
<th>Key benefits</th>
<th>Specific benefits</th>
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<tr>
<td>Improves performance</td>
<td>Improves comparisons between datasets for quantitative assessments and evaluations</td>
</tr>
<tr>
<td></td>
<td>Saves time and money in understanding a large range of guidance documents on best practice</td>
</tr>
<tr>
<td></td>
<td>Allows refinement and fine tuning</td>
</tr>
<tr>
<td>Reduces risk</td>
<td>Prepares industry in advance of operations through a systematic approach</td>
</tr>
<tr>
<td></td>
<td>Identifies risks, and assess how they might be minimized and/or mitigated</td>
</tr>
<tr>
<td></td>
<td>Ensures conformity with regulations and legislation</td>
</tr>
<tr>
<td>Increases consistency</td>
<td>Avoids inconsistent and different interpretations of information</td>
</tr>
<tr>
<td></td>
<td>Provides consistency between internal teams and projects</td>
</tr>
<tr>
<td></td>
<td>Provides consistency between companies and contractors</td>
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It is often assumed that increased environmental standards will impose significant costs on industry, impacting productivity adversely (Palmer et al. 1995). This conventional view has been challenged, however, by an alternative hypothesis which has argued that well-designed environmental regulations, with improved standardisation, encourages innovation, potentially increasing productivity and producing greater profits (Porter & van der Linde 1995). The benefits of protocols and standards may result in 1) increased efficiency in the use of resources, 2) greater corporate awareness, 3) lower risks that investments in environmental practices will be unprofitable, 4) greater innovation, and 5) a leveling of the playing field between operators (Porter & van der Linde 1995). The Porter and van der Linde hypothesis applies principally to productivity and market outputs. Additional environmental benefits may also occur, some of which may not outwardly have an immediate economic value other than for reputation and social license. When these benefits are considered together evidence-based studies suggest that environmental standardisation has positive outcomes for industry (Managi et al. 2005).

Compelling examples of the benefits of improved protocols and standards may be seen in other offshore industries, particularly the oil and gas industry. In the last 40 years offshore oil and gas has undergone a radical transformation in terms of the management of routine
safety and environmental activities. Reductions in the number of safety incidents and environmental hazards, and their consequences, have been made through advances in operational management, including regular improvements made through an iterative cycle of planning, implementation, monitoring and review. Protocols for best practice in operations have been developed, tested and refined over time. Effective operations have been taken up by trade organisations and made into industry-wide standards. Increasingly more rigorous legal regimes and pressures from stakeholders have enforced changes.

The deep-sea mining (DSM) industry has the opportunity to learn from developments in safety and environmental management practices in other industries. DSM is still predominantly in the planning stage offering a unique opportunity to implement best-practice guidelines and standards proactively from the offset. Although DSM will face some unique challenges, specific to the industry, many of the key environmental management issues — such as environmental impact assessment, monitoring and mitigation — have been considered and documented in detail already by allied industries. DSM has the potential to select and optimize recognised and documented best practices from the start. Regulators should be able to create comprehensive and clear guidance for DSM that increases profitability and ensures good safety and environmental management.

A major advantage in developing standardized best-practices for DSM is that there is one principal global regulator. Unlike most deep-water industries, it is likely that a significant amount of DSM will be carried out in areas beyond national jurisdiction, known as the “Area”. Under the UN Convention on the Law of the Sea (UNCLOS) the Area and its mineral resources have been designated as the “Common Heritage of Mankind”. Mining in the Area is controlled by the International Seabed Authority, an international body composed of States Parties to UNCLOS. The ISA is charged with managing the Area and its resources on behalf of all mankind, as a kind of trustee on behalf of present and future generations. The legal status of the Area and its resources influences every aspect of the ISA regime, including the determination of an adequate balance between facilitating mining and protecting the marine environment (Jaeckel 2015). The concept of the common heritage of mankind promotes the uniform application of the highest standards for the protection of the marine environment and the safe development of activities in the Area (Jaeckel 2015). Nation states encouraging deep-sea mining within their Exclusive Economic Zones (EEZs) must ensure that national rules and standards are “no less effective” than international rules and standards (Jaeckel 2015). This effectively means that protocols and standards adopted by the ISA should be incorporated into national legislation and regulations.

This desk-based review identifies and details existing protocols and standards relevant to the exploitation of deep-sea minerals. The protocols and standards may be enshrined
already in rules, regulations, and legislation or they have been adopted as best practice by industry and professional organisations. The review evaluates international and national regulations. Legislation for marine environmental impact assessment (EIA) is included, taking into account the quality indicators of the EU Marine Strategy Framework Directive (MSFD). Emphasis is placed on protocols and standards directly relevant to mining of polymetallic sulphides, polymetallic nodules, cobalt-rich ferro-manganese crusts and Rare Earth Elements (REEs). While this report does not relate specifically to the extraction of methane hydrates, the rules, regulations, legislation and best practices detailed here may be used to guide a future study addressing this resource specifically. Industries allied to deep-sea mining, such as aggregate extraction, deep-sea bottom trawling and offshore hydrocarbon exploitation, are included. This work is part of the Managing Impacts of Deep-seA reSource exploitation (MIDAS) project (grant agreement 603418) funded by the European Union Seventh Framework Programme (FP7/2007-2013). This MIDAS deliverable is a joint publication by MIDAS Work Packages WP7, WP8 and WP9.

The review is structured by considering the drivers for increasing sustainability before assessing management approaches that might be used by all key players in order to reduce the environmental impact of operations. It discusses the standards and protocols relevant to each step of the management cycle. A gap analysis is then presented highlighting areas in which new protocols and standards are required. The report also comments on whether standards being applied currently in deep water operations are valid for DSM, given the legal status of the Area and the ISA’s mandate to ensure effective protection of the marine environment from seabed mining-related activities means that environmental requirements may be set higher than for other industries. The review provides an overview and synthesis of a number of more lengthy documents reviewed by the MIDAS partners. Each of the documents is referenced to 44 Annexes, which can be consulted for further details and provide links to original documents and in-depth information.

External drivers for reducing the environmental impact of deep-sea mining

Environmental regulations relevant to deep-sea mining

The United Nations Convention on the Law of the Sea (UNCLOS) and the International Seabed Authority (ISA)
The international framework for controlling the prospecting and exploration for marine minerals in areas beyond national jurisdiction is fairly well developed owing to the work of the ISA. Provisions for the protection of the marine environment are detailed in UNCLOS(1982) and the subsequent ‘Agreement’ relating to the implementation of Part XI of UNCLOS (1994) (see Annex 1 of this document). In its 21 years of existence, the ISA has
adopted regulations and guidance for exploration activities, including test mining; in 2013 it commenced the development of regulations to govern the future exploitation of seabed minerals.

The ISA under UNCLOS article 145 is required to adopt appropriate rules, regulations and procedures for inter alia:

a) the prevention, reduction and control of pollution and other hazards to the marine environment, including the coastline, and of interference with the ecological balance of the marine environment, particular attention being paid to the need for protection from the harmful effects of such activities as drilling, dredging, excavation, disposal of waste, construction and operation or maintenance of installations, pipelines and other devices related to such activities;

b) the protection and conservation of the natural resources of the Area and the, prevention of damage to the flora and fauna of the marine environment.

Environmental standards relevant for seabed mining will also be informed by the obligations in Part XII of UNCLOS on Protection of the Marine Environment, which includes the fundamental obligation for States to protect and preserve the marine environment. including responsibilities to prevent, reduce and control pollution of the marine environment from any source, to monitor the risks or effects of pollution and to assess the potential effects of activities under States parties jurisdiction or control that may cause substantial pollution of or significant and harmful changes to the marine environment. (UNCLOS articles 204-206). In addition, States parties must take measures to protect and preserve rare or fragile ecosystems, as well as the habitats of depleted, threatened or endangered species and other forms of marine life (UNCLOS article 194.5). They must also prevent, reduce and control pollution resulting from the use of technologies under their jurisdiction or control and the intentional or accidental introduction of alien or new species to a particular part of the marine environment (UNCLOS article 196.1).

The international legal position is particularly important because, as well as filtering down to national legislation, the standards set in the international arena become the minimum for all operations. UNCLOS requires that national rules for pollution from seabed activities in the Area as well as within national jurisdiction to be no less effective than international rules, standards and recommended practices and procedures (UNCLOS articles 208-209).

**Guidance in other international agreements**
Activities within EEZs of individual States are influenced by decisions and voluntary guidelines issued by the UN Convention on Biological Diversity (CBD) (1992a) (Annex 2 and Annex 3). The CBD Guidelines on biodiversity-inclusive EIAs and SEAs are intended to inform
the implementation of environmental impact assessments (EIAs) and strategic environmental assessments (SEAs) for activities that may have significant adverse impacts in marine and coastal environments, including the deep sea, with a view to ensuring that such activities ‘do not compromise ecosystem integrity’. The CBD EIA Guidelines are not binding, but Parties to the CBD are ‘encouraged’ to apply them voluntarily. The CBD EIA Guidelines recognize that in open-ocean waters and deep-sea habitats the ability to predict indirect adverse impacts is limited, underlining the importance of the precautionary approach. The focus on ‘ecosystem integrity’ is a useful development as it encompasses not only biological diversity, but also what that diversity offers in terms of ecosystem processes and ecosystem services.

The CBD EIA guidelines discuss a number of interesting concepts to promote environmentally sound and sustainable development. When assessing mitigation for any potential impacts, the document advises that a number of alternatives might be considered, including location, scale, siting or layout, and technologies that might be used. In addition, restoration of impacted areas is anticipated; however, where ecosystem recovery is slow, such as in many deep-sea settings, restoration may be a less attractive option (Van Dover et al. 2014). Instead, there is a greater need to define measures to avoid, minimize or compensate for significant damage to, or loss of, biodiversity and/or ecosystem services. These concepts have been developed in other guidance (see sections below).

The European Union also has a number of detailed directives, including the EU Marine Strategic Framework Directive (MSFD) (2008/56/EC) (2008). The MSFD laid down criteria and methodological standards to enable some consistency in the approach by EU Member States in achieving Good Environmental Status (GES) for their waters by 2020. The MSFD required Member States to take into account monitoring requirements imposed by other European legislation, such as Habitat Directives (HD) and Bird Directives (BD) and international agreements, such as the regional seas convention (RSC). The determination of GES is based on 11 descriptors. These are biological diversity, non-indigenous species, commercial fish, food webs, eutrophication, sea floor integrity, alteration of hydrographical conditions, contaminants and pollution effects, contaminants in fish and other seafood, litter and energy / noise. The descriptor on ‘Seafloor Integrity’ is most pertinent to deep-sea mining. This descriptor is supported by Indicators for the extent different substrate types of the seabed are affected significantly by human activities. Rice et al. (2012) concluded that consideration of 8 attributes of the seabed system would provide adequate information to meet requirements of the MSFD for the seafloor integrity descriptor: (i) substratum, (ii) bioengineers, (iii) oxygen concentration, (iv) contaminants and hazardous substances, (v) species composition, (vi) size distribution, (vii) trophodynamics and (viii) energy flow and life history traits. To date there has been a lack of uniformity in the attributes used to
determine seafloor integrity among EU Member States but the Rice et al. (2012) report from ICES appears to indicate best practice.

While ‘Seafloor Integrity’ is the most relevant descriptor for deep-sea mining, all Criteria and Indicators should be considered because they may affect human activities directly or indirectly. Another important Indicator for assessing the environmental performance of mining operations is ‘Biological Diversity’; both habitats and species are recognised as key attributes. GES is considered to have been attained when 1) no further loss of diversity in genes, species and habitats/communities occur at ecologically relevant scales and 2) affected ecosystems are restored to target levels if intrinsic environmental conditions allow. In terms of ecosystem processes the MSFD focusses on maintaining each level of a food web within acceptable ranges in order to ensure long-term viability. While there are gaps & overlaps between descriptors (e.g. ‘Biological Diversity’ and ‘Seafloor Integrity’) taxonomic groupings and habitat types can be combined to satisfy the functional requirements of the descriptors for the MSFD. In deep-sea environments defining, measuring and monitoring GES will be a challenge owing to the limited information available on species diversity on any scale.

Regional Seas organisations, such as the Oslo Paris Commission (OSPAR), also have a role to play in managing coastal seas, Exclusive Economic Zones and Areas Beyond National Jurisdiction. OSPAR, for instance, has ‘Recommendations on the assessment of environmental impacts on threatened and/or declining species and habitats (Annex 4), including a list of threatened and/or declining species habitats (Annex 5), and has created a code of conduct for responsible marine research in the Deep Seas and High Seas of the OSPAR Maritime Region (Annex 6).

The UN Fisheries and Agriculture Organisation (FAO) has developed Guidelines (Annex 7) to assist States and regional fisheries management organizations (RFMOs) in managing deep-sea fisheries sustainably and in protecting biodiversity in the marine environment. The guidelines incorporate the requirements of UN General Assembly Resolution 61/105 on deep-sea bottom fisheries in the High Seas to assess the impacts of deep sea bottom fisheries and to manage such fisheries to “prevent significant adverse impact” on “vulnerable marine ecosystems” or not allow the fishery to proceed. In particular the Guidelines provide good definitions on ‘Vulnerable Marine Ecosystems’ (VMEs) and ‘Significant Adverse Impacts’ although how these terms are applied could be improved. For instance, examples of VMEs are provided in Annexes to the Guidelines. While the examples are useful in demonstrating the breadth of potential VMEs, the list has also been misinterpreted as being a definitive list of VMEs. The result is that the vast majority of deep-sea species are not being considered even though their biological characteristics, such as...
slow growth, late maturation and low reproductive output make them extremely vulnerable to repeated physical impacts. In addition, the Guidelines focus on fish rather than encompassing the whole ecosystem upon which the fisheries depend.

Drivers from primary stakeholders
In the case of mining in the Area, mining companies need a State sponsor. The State sponsor has to exercise due diligence to ensure that the mining company complies with ISA rules, regulations, standards and procedures. There is no specific guidance for this and at present relationships are developed on a case by case basis. There is a requirement, though, to follow Best Environmental Practice and for the sponsor to exercise a high degree of due diligence following a ruling in 2011 by the Seabed Disputes Chamber of International Tribunal for the Law of the Sea (ITLOS). The ruling is detailed in The Advisory Opinion of the ITLOS Seabed Disputes Chamber on the responsibilities and obligations of States sponsoring entities with respect to activities in the Area (Annex 8). The ruling stressed that “due diligence” includes the need for all States to ensure they have the administrative capacity to monitor, supervise and enforce their laws. No State is exempt from this requirement due to the need to avoid the potential rise of ‘sponsoring States of convenience’ applying weaker regulatory measures. This means that States may need to introduce new laws, administrative procedures and resources to regulate their enterprises to meet the expected standard. If laws are not enacted and enforced States may be held liable for damage including to the marine environment.

Many deep-sea mining operations will require external funding from large organisations, including international financial organisations and institutional investors. Increasingly financial backing for companies or projects is dependent upon the company or project meeting key environmental criteria or performance standards. Rules and advice are given by the World Bank (
Annex 9) and the International Finance Corporation (IFC) (Annex 10) on criteria that should be used when considering projects for finance and the performance standards that must be achieved. Projects for the World Bank are assessed on whether they are likely to have significant adverse environmental impacts and whether the ecosystems they affect are sensitive or particularly diverse. If the project is unprecedented, consideration might be given to the degree to which potential environmental effects are poorly known.

Around 70% of organisations providing project finance, across 36 countries, have signed up to the Equator Principles (The Equator Principles Association 2013). This group of 81 Equator Principles Financial Institutions (EPFIs) has agreed that for a company to receive investment or finance it must demonstrate that it meets eight Environmental and Social Performance Standards developed by the IFC (International Finance Corporation 2012). The Performance Standards provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way. Performance Standard 1 “Assessment and Management of Environmental and Social Risks and Impacts” establishes the importance of integrated environmental assessment, effective community engagement and management of environmental and social performance throughout the life of the project (International Finance Corporation 2012). Performance Standards 2 to 8 outline potential environmental and social risks and impacts that may require particular attention. Of key relevance for deep-sea mining is Performance Standard 6 “Biodiversity Conservation and Sustainable Management of Living Natural Resources”. Where risks are identified the company must manage them through its Environmental and Social Management System (ESMS) consistent with Performance Standard 1. Importantly, the IFC assesses projects as to whether their impacts might affect an area broader than the sites or facilities subject to physical works. IFC appraisals take into account the level of stakeholder engagement and participation in decision taking (Annex 11).

Although the effect may be minor, there is evidence that an increasing number of individual investors are using environmental considerations to inform their investment decisions (Havemann & Webster 1999). There are currently around 80 ethical investment funds available in the UK alone. These funds invest in companies based on objective environmental performance criteria. As a result, an increasing percentage of the ownership of a public company may be concerned with corporate sustainability and the share price may be partially driven by environmental performance. While a mining company may only directly benefit from this as part of an initial public offering, managers are usually shareholders and benefit from a high share price.
Guidance from other stakeholders

Most major industries now recognise the value in open reporting and public participation in environmental matters relating to their operations. The novelty of deep-sea mining, the significant effects mining might have on marine ecosystems and the track record of the mining industry on land, makes it imperative that environmental management decisions and the data and information on which those decisions are based are transparent. The International Seabed Authority publishes all its decisions and consultative documents in the seven official languages of the United Nations, and has recently held two rounds of stakeholder consultations on the development of new Regulations for the exploitation of deep-sea minerals. Yet the manner in which environmental information and data are shared and decisions are reached is poorly known and further moves to increase transparency and public consultation, particularly in relation to environmental matters, are expected.


The Aarhus Convention establishes a number of rights of the public to 1) access environmental information, 2) participate in decision procedures and 3) seek justice in environmental matters. The Convention focuses on procedural and governance aspects of environmental protection (government accountability, transparency and responsiveness). It links environmental rights and human rights and acknowledges obligations to future generations. It also establishes that sustainable development can be achieved only through the involvement of all stakeholders and links government accountability and environmental protection. The Convention encourages operators whose activities have a significant impact on the environment to inform the public regularly on the impacts of their activities.

The Almaty Guidelines detail the requirement of public participation at meetings in international forums and the entitlement of the public to have access to all documents produced for the meetings relevant to the decision-making process. The Guidelines also allow the public to circulate written statements and to speak at meetings, without prejudice to the ability of international forums to prioritize their business and apply their rules of procedure. The basic principles in the Aarhus Convention were reaffirmed by all Heads of State and governments, and made more broadly applicable through the Rio+20 Outcome Document : the Future We Want, from the UN Conference on Sustainable Development, Rio De Janeiro, Brazil. June 2012 (United Nations General Assembly 2012).
Approaches for reducing the environmental impact of deep-sea mining

Sectoral tools
A number of tools for reducing the environmental impacts of deep-sea mining are available. These have been created principally by the International Seabed Authority (ISA) and specialist groups tasked with helping nation states with deep-sea mining interests within their EEZs to develop the industry as sustainably as possible (e.g. the Secretariat of the Pacific Community). In addition to this, industry bodies, such as The International Marine Minerals Society (IMMS) have also developed Codes of Conduct for reducing the environmental impacts of mining operations in the sea.

Regulators environmental plans and codes
The ISA has brought together the main Regulations, Recommendations and Strategic Environmental Planning documents together into a Mining Code available from the home page of the organisation (www.isa.org.jm). This includes three separate sets of Regulations for the main types of mineral resources in the deep ocean: polymetallic nodules (International Seabed Authority 2010), polymetallic sulphides (International Seabed Authority 2012) and cobalt-rich crusts (International Seabed Authority 2009). The three sets of regulations are broadly similar in format, scope and content, with some differences reflecting primarily the different spatial and geological characteristics of the mineral resources. The regulations for polymetallic nodules are explored in greater detail in Annex 15, and act as a proxy for the content of the regulations for polymetallic sulphides and cobalt-rich crusts.

The ‘Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area’ (International Seabed Authority 2010) (Annex 15) set out contractual obligations for the initial prospecting and for the subsequent exploration of minerals. For prospecting and exploration activities contractors are required to minimize or eliminate adverse environmental impacts and prevent conflicts or interference with marine scientific research activities (Reg 5). Prospecting is not to be undertaken if “substantial evidence indicates the risk of serious harm to the marine environment” (Reg.2(2)). How this is determined depends to a large extent on the risks and sensitivities outlined in the environmental management plans of each contractor and how risks to the environment are assessed, reported and monitored. While contractors are obliged to provide an annual report on their prospecting and exploration activities there are no formal requirements for the creation of an environmental management system. However, contractors are obliged to follow the ‘Recommendations for the Guidance of Contractors for the Assessment of the possible Environmental Impacts Arising from Exploration for Marine Minerals in the Area’ (Annex 32), which includes the submission by contractors of prior Environmental Impact
Assessments (EIAs) for any exploration activities that might be considered to have the potential to cause serious harmful effects, which would need to be agreed with the ISA.

The ISA also has broader management obligations in relation to the preservation of the marine environment. It is required to establish and keep under periodic review environmental rules, regulations and procedures to “ensure effective protection for the marine environment from harmful effects which may arise from activities in the Area”. This includes obligations of the Authority and sponsoring States to apply 1) a “precautionary approach”, as reflected in principle 15 of the Rio Declaration (1992b), and 2) best environmental practices. There are responsibilities for the ISA Legal and Technical Commission to develop and implement procedures for determining whether proposed exploration activities would have “serious harmful effects on vulnerable marine ecosystems” and whether activities are managed to prevent such effects or not authorized to proceed.

The initial work by the ISA has in recent years been augmented substantially by developments within the Exclusive Economic Zones of the Pacific Island States through a joint programme of work at the Secretariat of the Pacific Community (SPC) in Fiji, supported by funding from the European Commission. SPC has developed a Regional Legislative and Regulatory Framework (RLRF) for Deep-Sea Mineral Exploration and Exploitation (Secretariat of the Pacific Community 2012)(Annex 16). International law requires that appropriate environmental standards are governed by domestic legislation, and must be implemented with monitoring and enforcement. With respect to environmental impact assessments, an effects-based approach is recommended to trigger the extent and type of EIA that is required where lower-impact activities or ones with well-known effects would require less information and analysis than a large-scale and novel activity. The anticipated effects and impacts of activities would trigger a process to assess whether the activity should be 1) ‘permitted’ without license (subject to provision of certain information), 2) permitted subject to specific requirements including an EIA and environmental management plan (‘discretionary’) or 3) ‘prohibited’. In assessing the impact of DSM activities and any associated activities, an “ecosystem services” approach is recommended which recognizes that ecosystems provide a wider variety of services that just resources. Where after review of the EIA, a DSM project is permitted to proceed, an EMP (see below) is needed to specify the conditions under which the activity may proceed. The RLRF foresees the need for legislation to make provision for a Regulating Authority to be able to delegate functions, such as the assessment of mining applications or the review of EIA information, to an expert panel. The RLRF provides a staged approach to decision making and affirms the need for public participation in decision-taking with reasonable provision to avoid vexatious interventions.
The RLRF covers issues on applying the Precautionary Approach by stressing the need to avoid the occurrence of irreversible damage. Seeking out alternatives to the proposed action as well as ongoing monitoring and research are also essential components of the precautionary approach. Where there is a possibility of an adverse effect, the provision of evidence that the nature or extent of this will be acceptable will rest with the operator. Adaptive management techniques can be applied to allow some activities to proceed despite uncertainty provided appropriate checks and risk-minimising controls are in place. Based on the results of careful monitoring, activities may be adjusted as information improves. Regular reporting would be required as a condition of a license, including confirmation that best practices including risk-minimising controls, are being employed. The RLRF recognizes that in developing policies for mining activities, integrated governance, based on the concept of ‘the ecosystem approach’, is needed. Ecosystem-Based Management would allow activities of different sectors to be assessed and planned jointly to reduce cumulative impacts on the environment.

For deep-sea mining in areas beyond national jurisdiction (ABNJ) the International Seabed Authority (ISA) is considering issues of corporate social responsibility as part of its development of a framework for the exploitation of deep-sea minerals (Annex 17) (International Seabed Authority 2013). This may become a particularly important issue owing to the participation of many developing nations in the ISA, several of which will have faced social and environmental issues from mining activities on land. While individual contractors to the ISA will develop their own approaches to corporate responsibility, the ISA also needs to consider its role in ensuring good business ethics in the remote areas of the ocean.

**Industry bodies**

Leading players from industry, Governments and scientific institutions have already created a Voluntary Code for the Environmental Management of Marine Mining through the International Marine Mining Society (IMMS) (International Marine Minerals Society 2011) (Annex 18). In Areas beyond National Jurisdiction the International Seabed Authority (ISA) has encouraged its contractors to apply the IMMS Code (ISA, 2011, Section VII B, page 12). As the ISA notes “The Code consists of a statement of Environmental Principles for the marine mining industry, followed by a set of Operating Guidelines for application as appropriate at specific mining sites. These Guidelines are designed to serve industry, regulatory agencies and other stakeholders as benchmarks for development, implementation and assessment of environmental management plans and as advice on best practices at sites targeted for marine mineral research, exploration and extraction. The Principles and Guidelines set broad directions in a context of shared values rather than prescribing specific practices.”
Companies adopting the IMMS Code commit themselves to a number of high level management actions; to observe all laws and regulations, apply best practice and fit-for-purpose procedures, observe the Precautionary Approach, consult with stakeholders, facilitate community partnerships on environmental matters, maintain a quality review programme, and transparent reporting. The Code also contains guidance on responsible and sustainable development, company ethics, partnerships, environmental risk management, environmental rehabilitation, decommissioning, the collection, exchange and archiving of data, and the setting of performance targets, reporting procedures and compliance reviews.

The IMMS Code foresees the need for companies to develop environmentally responsible ethics by showing management commitment, implementing environmental management systems, and providing time and resources to demonstrate environmental commitment by employees, contractors and suppliers of equipment, goods and services. Specific recommendations are made on reviewing, improving and updating environmental policies and standards, as well as communicating these at business and scientific meetings. Every three years or so a company should evaluate its environmental performance under the Code using a team of qualified, externally accredited environmental auditors from within, and independent of, the company.

**Strategies for development regions**

It is likely that DSM will occur in a relatively small number of areas, such as the Clarion Clipperton Zone in the equatorial eastern Pacific, mid ocean ridge systems and a few selected seamounts. There are many environmental issues that are common to any particular development in all of these areas. However, some potential environmental risks may extend beyond the boundary of a single mining site, while others may lead to cumulative impacts in association with other uses of marine space (such as deep-water fisheries). Environmental risks, therefore, need to be considered at a broad (regional) scale and environmental management procedures may need to be tailored to the resources and ecosystems under pressure. As a result, it is important to develop approaches for environmental management within a Strategic Environmental Assessment.

**Strategic Environmental Assessment (SEA)**

The term Strategic Environmental Assessment is used in slightly different ways in different documents. In some circumstances it refers to the assessment of a plan, policies, programmes or even technology before its approval, to make sure that environmental considerations, including biodiversity are included at the planning stage. It is a key tool for sustainable development and helps to gauge the full array of potential impacts. Alternatives may be considered at a high level with close public and expert consultation and engagement. In other instances a SEA is used to evaluate the wider regional context within
which multiple and different activities are set. It is clear from the international guidelines described above that there is a need to manage the marine environment across business sectors and at larger scales than any one activity. A regional-scale SEA might help to resolve competing demands for different resources for the same space and/or consider their cumulative impacts. These two approaches are not mutually exclusive, but represent the need for a broad planning view. SEAs therefore need to be formulated at an early stage, but are ongoing and should be adapted with time. They may include, for instance, provisions for representative networks of systems of Marine Protected Areas (MPAs) before specific activities commence, and for adjustments in MPA provisions with time. The European Strategic Environmental Assessment (SEA) Directive (2001/42/EC) (2001) (Annex 19) approaches a SEA as an early management action in order to allow biodiversity and other environmental considerations to be included in the development of new plans, policies and programmes. In terms of matters that might be considered in the deep-sea context the list might include:

- the probability, duration, frequency and reversibility of environmental impacts
- the cumulative nature of the impacts
- the transboundary nature of the effects
- the risks to human health or the environment (e.g. owing to accidents),
- the magnitude and spatial extent of the effects (the geographical area likely to be affected)
- the value and vulnerability of the area likely to be affected
- the effects on areas which have a recognised national, Community or international protection status
- The extent of uncertainty in any of the above.

In the case of the geographic area that might be affected this includes the depth range over which activities will have an effect; the deep sea is a dynamic 3-dimensional space, much more so than land. In total the sea provides 98.5% of the living space for life on Earth, whereas on land life is restricted to a thin veneer seldom more than 100m above the surface. Plumes from seabed mining may be extensive. The EU SEA Directive was formulated mainly with terrestrial issues in mind, and so needs to be adapted for the marine environment. Changes with time are also of particular importance in the deep ocean owing to the slow recovery time of most deep-sea ecosystems.

Overall, the SEA Directive contributes to the systematic and structured consideration of environmental concerns in planning processes and provides better integration of environmental considerations upstream. In addition, by means of its requirements (environmental report, consultation and information for the authorities and public
concerned etc.) it ensures better and harmonized planning procedures, and contributes to transparent and participatory decision-making processes.

The Protocol on Strategic Environmental Assessment to the Espoo Convention (2003d) (Annex 20) follows a similar line to the EU SEA Directive (2001) and seeks to integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. The Protocol was negotiated under United Nations Economic Commission for Europe (UNECE), but is open to all UN members. The Protocol provides for extensive public participation in government decision-making. The public not only has the right to know about plans and programmes, but also the right to comment, have their comments taken into account, be told of the final decision and why it was taken.

The EU SEA Directive has guided a number of industries and how they operate. SEA has been undertaken for the offshore oil and gas exploration and production sector for several years (Annex 21). A key aim is to provide a mechanism for public consultation of a Member State’s plan for offshore oil and gas exploration and development, as well as informing Governments of the environmental issues. In addition, SEAs provide oil and gas companies with a framework for understanding the sector’s potential impacts, thus providing a basis for monitoring good environmental performance.

Not all industries follow the EU SEA Directive explicitly, but have adapted the SEA approach to meet their particular needs (e.g. ‘Zonal Environmental Appraisal’ (ZEA) for the UK East Anglia Offshore Wind Farm development (Annex 22) and ‘Regional Environmental Assessment’ (REA) for the UK Marine Aggregate Regional Environmental Assessments (MAREA) (Annex 23)). Both ZEAs and REAs consider cumulative impacts; in the former case taking into account the effects of multiple wind turbine structures and in the latter case numerous and repeated dredging operations. In the case of dredging the impacts of existing licenses up for renewal are considered with applications developing new areas.

The adoption of a SEA specific for a particular industry, resource or region can also be seen directly in deep-sea mining. The ISA has adopted a regional (strategic) environmental management plan (SEMP) in the Clarion Clipperton Zone (CCZ) in the equatorial Eastern Pacific Ocean (Annex 24). The SEMP for the CCZ incorporates many of the aspects of an SEA process for polymetallic nodule mining. The SEMP for the CCZ was adopted in 2012 to set aside c. 1.5 million km² of seabed in order to protect the full range of habitats and biodiversity across the CCZ. The CCZ is a vast area of seabed covering in total some 4.5 million km²). The EMP adopts a holistic approach to the environmental management of the CCZ in its entirety, including, where appropriate, consideration of cumulative impacts, and incorporating EIAs of new and developing technologies. The CCZ EMP aims 1) to maintain regional biodiversity, ecosystem structure and ecosystem function across the CCZ, 2)
manage the CCZ consistent with the principles of integrated ecosystem-based management and 3) enable the preservation of representative and unique marine ecosystems. For this purpose, the CCZ SEMP establishes an initial set of nine “Areas of Particular Environmental Interest” as no-mining areas. It left some flexibility as the boundaries may be modified based on improved scientific information about the location of mining activity, measurements of actual impacts from mining operations, and more biological data if equivalent protection can be achieved.

In 2013, the United Nations General Assembly in 2013 invited the LTC to prioritize the development of SEMPs for other regions of mining interest, and a strategy for the development of further strategic environmental management plans is now a priority for the ISA over the next 12-18 months. The strategy is to build on the ISA’s experience with the establishment of the environmental management plan for the CCZ.

**Strategies for projects**

Some environmental management approaches can only be implemented within a clearly-defined project location, where the planned activities and the environment are known in detail. These site-specific environmental management plans (e.g. the proposed Solwara 1 development by Nautilus Minerals within the deep-water EEZ of Papua New Guinea – see below) require a mining plan to be submitted to the local authorities prior to the commencement of mining operations. Project-specific environmental assessments are common for most major developments and there is a huge body of internationally approved approaches for successfully identifying and mitigating impacts, including an Environmental Impact Assessment process to obtain an environmental license. Such risk assessment approaches aim to avoid, mitigate and, potentially, compensate for environmental impacts. Environmental assessments should take into account all known characteristics of the ecosystems that may warrant extra protection (VanDover et al. 2011, Collins et al. 2013, Schlacher et al. 2014).

**Environmental Impact Assessment (EIA)**

An EIA describes the major impacts of an activity on the environment in terms of its nature, extent, intensity and persistence. It addresses the sensitivity and/or vulnerability of all habitats that may be affected and the ability of those habitats to recover from harm, including cumulative effects. Cumulative effects may occur from a number of repeated impacts, the sum of different impacts and, in some cases, the combined effects of human impacts and climate change. Using this assessment a plan can be developed to mitigate the impacts.
An EIA Report brings together all the information generated from environmental baseline studies, EIAs, socio-economic studies, proposals for mitigation of impacts and details of how operations and their effects will be monitored. The EIA Report should include a description of the proposed development, its objectives and potential benefits, compliance with legislation, regulation and guidelines, stakeholder consultations and closure plans. While an EIA Report is generally specific to one project it may have to take into account other activities, environmental planning provisions and business sectors in the region and the possible cumulative impacts of the proposed activity with these other operations. It may also have to take into account effects of any reasonably foreseeable future impacts (e.g. climate change and ocean acidification). An EIA Report (EIS) is often required to obtain an environmental permit to allow a project or operations to go ahead.

The EIA Report contains a set of commitments to avoid, and to minimise or reduce the environmental (and social) impacts of a project to an acceptable level (and in some instances to offset or compensate for the effects). It is essential, for the stakeholders and regulators to have confidence in the EIA report, that these commitments are unambiguously expressed and that there is a clear means set out for delivering on the commitments made. The outcomes of the EIA Report and subsequent consultation are taken up in an Environmental Management and Monitoring Plan (EMMP) (sometimes the word Social is also included) and the EIA Report should contain at least a provisional EMMP or a framework for one. Where the EMMP is provisional the means for taking it through to completion should be detailed, including the roles of contractors and consultation and disclosure on the content of the EMMP as it develops.

There are many different terms that have been applied to environmental management documents and procedures, including environmental risk assessments (ERAs), environmental impact assessments (EIAs), environmental management plans (EMP), environmental impacts statements (EISs). In addition, terms such as EIAs are used in different ways, from impacts made by one type of gear or operation, to all the impacts that may be created by a business venture, such as a whole mine site. Here the revised terminology advised in the updated (2014) EU Directive on EIAs is used (Annex 25), with reports referred to as “EIA Reports” rather than EIS. Confusingly, an EIA report is termed an “EIS” under current PNG legislation.

**European Guidance for EIAs and related international advice**

European guidance on EIAs has been available since 1985, but has been updated several times, most recently in 2014 (EU EIA Directive 2014/52/EU) (2014) (Annex 25). The EIA process makes sure that environmental issues are considered when a project or plan is first discussed.
Screening is the first formal consultation stage in an EIA by which a project is assessed to determine whether or not the production of a statutory EIA Report (EIS) is required. Screening takes into account project characteristics (size; cumulatively with other projects; use of natural resources; production of waste; pollutions and nuisances; risk of accidents, risk to human health) and project location (existing land/seabed use; abundance, quality and regenerative capacity of natural resources in the area; absorption capacity of natural environment). Screening also considers potential impacts of the project in terms of extent, transboundary effects, magnitude and complexity, probability, and duration, frequency and reversibility. Screening may involve a consultation stage with stakeholders.

The International Finance Corporation Biodiversity Guide (The Social and Environmental Impact Assessment Process) (International Finance Corporation 2015) contains similar advice, but adds the need to consider significant biodiversity value (e.g. endangered species, proximity to protected areas or critical natural habitats), impacts to ecosystem services and the technologies that will be used. It suggests that where biodiversity information is scarce or absent, it may be advisable to undertake a short-term rapid assessment of biodiversity resources, to identify major issues which might then be fully assessed in subsequent stages of the Social and Environmental Impact Assessment.

In the European Directive it is advised that the competent authority should, where requested by the developer, issue an opinion on the scope and level of detail of the environmental information to be submitted in the form of an environmental impact assessment report (‘scoping’). This will improve the quality of an environmental impact assessment, simplify procedures and streamline the decision-making process. Scoping should determine the content and extent of the issues to be covered in the EIA. It should determine the information to be submitted to the regulator, the level of detail required, and identify actions to be taken to compile the required information. Scoping may be undertaken by the competent authority or in consultation with the applicant. According to the UK Marine Management Organisation (MMO) scoping should include a project description, a summary of installation and decommissioning methods, project location (covering all project aspects) with mapping, a list of receptors expected to be affected at each stage and by each activity, the identification of potential environmental impacts (including likelihood and magnitude) and information on how assessment will be carried out (e.g. technical studies, methodologies, resources).

The International Finance Corporation (IFC) Biodiversity Guide suggests in addition that the scoping study identifies data availability and gaps, as well as suitable survey, research and assessment methodologies. Scoping should also define the appropriate spatial and temporal boundaries for assessment. The IFC advises that consultation with government officials,
conservation organisations and local communities should be carried out at this stage to identify key impacts and linkages with local livelihoods and social issues, and to gather feedback in order to produce final assessment plan.


Scoping studies are also required to consider transboundary effects. The Espoo Convention on EIA in a transboundary context (1991) (Annex 27) lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

**Existing example of an EIA and an EIA Report (EIS) for deep-sea mining**

While no deep-sea mining has taken place, Nautilus Minerals BV are planning to start mining in the EEZ of Papua New Guinea (PNG) within the next three years. As a result, the company has received an environmental permit based on a comprehensive EIA Report (termed an “EIS” under PNG legislation) submitted to the Government of PNG (Annex 28). The development of the ‘Solwara 1’ mining project (Nautilus Minerals 2008) for polymetallic Seafloor Massive Sulphides (SMS) has set standards and protocols that may be followed, and potentially improved on, by future deep-sea mining developments, but at present it can be regarded as current Best Practice. The EIS submitted to the PNG Government related to mining at the seafloor using a Seafloor Mining Tool (SMT), the pumping of the ore up to a Mining Support Vessel (MSV) via a riser and lift system (RALS), the dewatering of the ore, the disposal of the fine tailings, and the barging of the dewatered ore to a facility in PNG. A second EIS will be submitted to the PNG Government for the activities of the processing of the ore on land.

As a matter of priority Nautilus Minerals recognised the importance of dedicating considerable time to environmental studies as part of its environmental data acquisition. Substantial knowledge has been generated, which in turn has led to innovative mitigation strategies. The close association of scientific research with environmental and resource management has set a new standard for all future mining activities in little-known deep-water environments. A number of international and national protocols and standards were specified including the MARPOL 73/78 Convention (1978) and the Australian Protection of the Sea (Prevention of Pollution from Ships) Act 1983, the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) standards. The
An environmental plan allows for mitigation strategies to assist the recovery of benthic ecosystems. These include the preservation of almost identical communities, in terms of species, abundance, biomass, diversity and community structure, at a locality within 2km upstream. This, it is thought, will allow natural recolonisation of the mined area to occur and will be monitored during mining operations. In addition, active restoration will occur by the translocation of faunal groups from areas about to be mined to those areas were mining is complete.

A monitoring plan will be submitted to PNG as part of an Environmental Management Plan (EMP) before mining begins. The EMP will monitor and report on compliance with regulatory permits and licenses, including the validation of predicted impacts, the documentation of any unanticipated events and the introduction of additional management measures. Nautilus Minerals will use an environmental management system developed in accordance with the international EMS standard, ISO 14001:2004, as adapted for use in Australia and New Zealand (AS/NZS ISO 14001:2004).

International guidance for EIA and EIA Report (EIS) documents for deep-sea mining

Two guidance documents for EIAs and EISs have been published in recent years relating to mining activities. The ISA in association with the Secretariat of the Pacific Community, Fiji, created an EIA template to guide prospective developers planning to carry out mineral exploitation activities, including the creation of a comprehensive Environmental Impact Statement (EIS) (Annex 28, Annex 29). The ISA guidance was a first pass at an EIA template, but the work started in Fiji has now been refined to a large extent by guidelines for EIAs relating to offshore mining and drilling in New Zealand waters (Annex 30).

The New Zealand document addresses different aspects of uncertainty. Following the identification of sources of uncertainty and mitigation to reduce risks, there may be elements of unavoidable risk. The case for an uncertain element of the EIA may require the use of predictive models. The NZ document provides some wise observations on how models are described, validated, reviewed and tested against other models, including the validity of the input data used to drive the model. Several cases of how residual uncertainty have been dealt with for deep-sea mining are apparent in the EIS devised by Nautilus Minerals for deep-water mining in PNG waters (described above).
For biological information the baseline data and monitoring plan should allow impacts to be evaluated and compared with the scale of variation expected from natural change. Measures of the rate of recovery of faunal communities and ecosystem function will be particularly important. Details of genetic diversity, connectivity and food webs may be required. Residual uncertainty or risks that cannot be mitigated for, may need to be addresses by statistical and probability analyses to assess the likelihood of a particular outcome occurring. A comparison of the mining site and reference areas to wider knowledge of biological communities in the region should be made. Spatial management options are likely to be a major solution for how residual impacts can be managed. In many cases existing Standards and Protocols on tailings discharges relate to the offshore drilling operations in the oil and gas sector; the New Zealand report notes that discharges from mining may be rather different.

Apart from environmental effects of mining, the New Zealand report also considers socio-economic impacts, including fisheries, shipping, tourism, scientific research, areas of historical or cultural value, job creation, and sharing of equity from the mining operation.

**Baseline studies for Environmental Impact Assessments**

All EIAs include a baseline against which the effects of the Project can be assessed. The baseline describes the physical, biological and human environmental conditions that will prevail in the absence of the Project, together with interactions between elements of them. In some offshore developments in allied industries baseline data are obtained by desk-based literature review, but all deep-sea mining projects are expected to require acquisition of new baseline data specific to the project prior to test operations and full-scale mining. Typically the baseline study will identify the pre-Project conditions and highlight habitats and species that may be vulnerable. The study will describe and quantify environmental characteristics and may provide predictive modelling of some aspects to inform judgements about the quality, importance, and sensitivity of environmental variables to the impacts identified during the scoping process.

For deep-sea mining the ISA has issued guidance to contractors on the elements required in baseline studies (International Seabed Authority 2010)(Annex 31). These are part of ‘Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration of minerals in the Area’ by the ISA Legal and Technical Commission (LTC) (hereafter referred to as the ‘LTC Assessment Recommendations’), the expert advisory body to the decision-making ISA Council. Contractors agree to follow the LTC Assessment Recommendations and any amendments made. The LTC Assessment Recommendations are updated regularly and cover all three main mineral resource types: polymetallic nodules, polymetallic sulphides and cobalt-rich
crusts. While the LTC Assessment Recommendations apply to international waters they may also set standards for baseline studies within Exclusive Economic Zones (EEZs) of individual States. Given the technical nature of the LTC Assessment Recommendations an explanatory commentary is also provided by the LTC as an Annex to the document, which includes a glossary of technical terms. Details are given of activities for which a prior EIA needs to be agreed with the ISA. This includes all test mining activities.

The LTC Assessment Recommendations define the biological, chemical, geological and physical measurements to be made and the procedures to be followed to ensure effective protection for the marine environment from harmful effects that may arise from the contractors’ activities. Every plan of work for marine minerals must not only provide environmental baseline data but also include a plan for monitoring to ensure that no serious harm is caused to the marine environment. This includes monitoring before, during and after testing of collecting systems and equipment. Information is required from the exploration area to document the natural conditions that exist prior to test mining, to determine natural processes such as dispersion and settling of particles and benthic faunal succession, and to gather data to make accurate environmental impact predictions at the sea-surface, in mid-water and on the seabed.

While the LTC Assessment Recommendations do not stipulate Best Available Technologies and Best Environmental Practices, it recognises that data of sufficient quality are required for effective Environmental Impact Statements to be submitted, including accurate Geographic Information System (GIS) mapping and the generation of statistically significant results for environmental management, which may depend on sample number, sample size, faunal abundances and locality.

The LTC Assessment Recommendations provide details of international standards to be attained for various measurements. Physical oceanographic data are required to be collected to World Ocean Circulation Experiment (WOCE) and Climate Variability and Predictability Research (CLIVAR) standards. Protocols for chemical parameters are listed in Chapter 23 of the ISA’s ‘Standardization of Environmental Data and Information: Development of Guidelines’. All measurements must be accurate and in conformance with accepted international scientific standards as detailed by the CLIVAR (Climate and Ocean: Variability, Predictability and Change) and GEOTRACES (International Study of Marine Biogeochemical Cycles of Trace Elements and their Isotopes) protocols. The requirement to use ISO 9001 reporting and document control for analytical systems used in the field and in the laboratory, could be added to the ‘LTC Recommendations’. Clear ‘Quality Control’ procedures, such as retaining copies of all raw data and flagging of any erroneous data that
has been removed and the reasons for doing so, are required. Verification by third party laboratories may be needed to achieve quality control.

For geological data the ISA requires (GIS) regional maps to be produced with high resolution bathymetry produced at a scale appropriate to the resource and habitat variability. Guidance from allied industries, for example IOGP (The International Association of Oil & Gas Producers 2012), requires GIS data to conform to the ISO 19100 family of Geographic Information Quality Standards. These include pertinent standards for quality (ISO 19113, ISO 19114, ISO 19138), spatial referencing (ISO 19111) and metadata (ISO 19115 and ISO 19139).

The area of biological data is probably the most complex, but it is recognised that standardization of methodology and reporting of the results is extremely important. The ISA has organized expert workshops to address this issue and the conclusions made will be taken up in revision of the ‘LTC Recommendations’ (Annex 32). The advice includes standardization of instruments and equipment, sample collection, treatment and preservation techniques, quality control on board vessels (such as sieving methods for sediment faunal samples), quality control in laboratories (such as sorting and taxonomic identifications), data processing methods, statistical analyses and reporting. The ‘LTC Regulations’ provide detailed information of the key sampling procedures for the different nominal size categories of the benthos and bentho-pelagic (megafauna, macrofauna, meiofauna, scavengers and fauna attached to nodules). There is a major gap in standards and protocols for pelagic fauna generally. For all environmental data the ‘LTC Recommendations’ advise that the data are made available at world data centres, national oceanographic data centres and the ISA. Workshops on megafauna (June 2013) and macrofauna (November 2014) have been held to date.

In relation to other marine business sectors some additional factors should be noted. The extraction of marine aggregates has been controlled by EIAs for some time. As operations have evolved over time and a more complete understanding of physical impacts and biological effects has been achieved, the baseline and monitoring requirements have simplified to a focus on key indicators of environmental change. This approach of using key indicators or proxies of environmental change may eventually be suitable for deep-sea ecosystems. For offshore wind developments baseline studies are required to collect two years’ worth of baseline data for marine mammals and seabirds in order to reduce the possibility that seasonal variations will not be characterized if sampling occurs only during a ‘non-normal’ year. In the deep sea this also important where long term (decadal) and episodic change is known occur in some areas. The International Finance Corporation (IFC) Biodiversity Guide requires ecosystem services and a project’s effects on them to be
considered. This may require the participation of stakeholders to determine the benefits (actual and perceived) provided by ecosystem services.

In the case of deep-sea mining it is expected that the baseline study will form the basis for subsequent monitoring of environmental change during a test mining phase, in particular the rate of recovery of deep-sea ecosystems. Test mining will be at an appropriate scale not only to test prototype technologies but also impacts on the environment that may approach the scale of impacts to be expected during mining. Monitoring will demonstrate the predictions made in the EIA are broadly correct, show that mitigation is working as planned, address any uncertainties, demonstrate compliance with the approval conditions, allow the early identification of unexpected or unforeseen effects, and supports the principle of ‘adaptive management’.

Environmental Management and Monitoring Plan (EMMP)

Monitoring procedures and the standards to be followed should be detailed in a separate Environmental Management (and Monitoring) Plan (EMP, or EMMP in some cases). An Environmental Management and Monitoring Plan is a project-specific plan developed to ensure that all necessary measures are identified and implemented in order to minimize the harm to the environment, monitor the impacts of a project and to comply with environmental legislation. The EMMP should clearly detail how environmental management and monitoring activities will be accomplished through the elaboration of specific objectives, components and activities, inputs (human, physical, financial) and outputs. A clear budget and schedule for implementation is also required, with identification of the agencies responsible for financing, supervision and implementation, and other relevant stakeholders’ interests, roles and responsibilities. The International Finance Corporation’s Performance Standard 6, although specific to biodiversity, presents some useful focus areas that can readily be incorporated into EMMP. These areas are: 1) Critical Habitat Assessment, where the ecological importance of a development area is assessed (e.g. for threatened and restricted-range species and ecosystems, protected areas) in comparison to the global distribution (of a species or habitat) or to the known population size; 2) Mitigation Design; 3) Offset Design; 4) Protected Area Assessment, including legally protected areas or ‘internationally recognised areas’ that might be impacted; and 5) Monitoring and Evaluation Design, which is sufficient to demonstrate ‘biodiversity gains’ in a statistically-defensible way.

ISA DSM contractors are required to establish and carry out a programme to monitor and report on the effects of their activities. There is a reasonable expectation that in time this will be formalised in Environmental Management and Monitoring Plans particularly in relation to test mining and to exploitation.
In creating monitoring programmes for deep-sea ecosystems other marine business sectors have useful experience to consider. For the monitoring of marine aggregate extraction under license a Vessel Management System (VMS) is used to record (and report) where extraction is taking place, and for how long. VMS can be used to demonstrate that extraction has not occurred beyond the space and time limits set. Of equal importance it demonstrates that exclusion zones (e.g. to protect marine protected areas) have been adhered to. Periodic surveys of particle size distribution are required to establish other physical changes have occurred which would affect the recovery of benthic fauna once dredging ceases. Continued monitoring of environmental conditions is required once dredging has ended. Over time the monitoring requirements have been reviewed and changed recognizing the need to extend the monitoring surveys, for example to use drop down video surveys and beam trawls for epibenthos sampling.

In European Directives monitoring issues are discussed in relation to biological diversity (Annex 33). Of particular note the Directives highlight the need for a minimum monitoring frequency to be set, which may differ for the various elements being monitored. Of particular concern offshore is the monitoring of plumes caused by DSM operations, either directly at the seabed or within the water column, created by the mining equipment or if tailings are released following initial processing of the ore on a surface vessel. In this respect guidance from other UN bodies, such as the International Maritime Organisation (IMO) or London Convention/London Protocol (1972), may be required (Annex 34). IMO Guidelines for Ballast Water Management (Annex 35) and Garbage Management (Annex 36) should also be adopted. All contractors to the ISA are required to follow the IMO International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 in order to minimize pollution of the oceans and seas, including dumping, oil and air pollution.

Nautilus Minerals BV will submit an Environmental Management Plan to the Government of Papua New Guinea for approval prior to the commissioning of the Solwara 1. The preparation and approval of the EMP is a condition of the approval of an environmental permit for mining. The EMP will demonstrate how Nautilus Mineral’s environmental policy will be implemented and will address the management, monitoring and reporting requirements for the various phases of the Project; e.g., baseline, operations and decommissioning, accounting for both the commitments made in the EIS (see Annex 28) and the conditions of approval stipulated by the State. The EMS will include how validation of the predicted impacts and the identification of unforeseen effects will be assessed, as well as how any needs for additional management measures will be implemented.
Mitigation hierarchy
The guiding principle in the development of the EMMP and associated regulations and permit requirements is to prevent or avoid adverse impacts on the environment. Where prevention is not possible, the EMMP should identify ways to minimise or mitigate against adverse impacts. Compensation, or offset (e.g. the conservation of the environment elsewhere) should be viewed as a last resort. This tiered “Mitigation Hierarchy” is integral to the International Finance Corporation’s Performance Standard 6. There is extensive guidance for implementing the mitigation hierarchy in extractive industries prepared by the Cross Sector Biodiversity Initiative (Ekstrom et al. 2015).

The first two tiers of the hierarchy, avoidance and minimisation, prevent the impacts from occurring and thus deserve particular emphasis. Indeed, these principles are referred to throughout guidance for DSM. The last tiers of the hierarchy, restoration and offsetting, are remediative, as they seek to compensate for unavoidable damage to biodiversity. The remediative stages have been little explored in the case of DSM (see Van Dover et al. 2014) and, in deep water, are expected to be costly and have uncertain outcomes (Ekstrom et al. 2015). Within the “restoration” hierarchy applied in US wetlands law is (1) restoration of site, (2) enhancement of existing site, (3) establishment of new site, and (4) preservation of alternate site. Preservation may be needed to satisfy restoration requirements to some degree. In the wetlands context which has a no net loss policy, compensatory restoration is usually a 2:1 thing—i.e. 2 acres restored for every 1 acre lost. However, if preservation is used, it typically is more like 10:1—10 acres protected for every 1 acre lost. Given the high degree of scientific uncertainty and complete inability to restore a site (with the possible exception of active hydrothermal vents), a similar approach may be needed for DSM.

Another aspect to include in the mitigation framework is the potential to use offsets to fund baseline research and/or monitoring for long-term management of site. Also, not ideal in settings where actual restoration is possible.

Where significant impacts are unavoidable then spatial planning at a regional scale using networks of marine protected areas would be a necessary complement to site specific measures to reduce impacts, especially in the deep sea. If, as a final option, offsetting occurs it should focus on replacing or enhancing similar habitats rather than, say, creating coastal fish reefs in compensation for impacts on abyssal plains.

Tools used within the company
Within individual contractors environmental management approaches can be developed and used to reduce the risk of any damage arising out of “wrongful acts” in the conduct of their operations. Many approaches have been developed for organisations to better manage their environmental impacts and these are widely adopted in large offshore
industries, such as oil and gas. At a fundamental level, the corporate structure of the organisation needs to be such that environmental issues are raised and dealt with at the highest levels of the business. In addition, processes should be in place that show the company’s commitment to environmental issues and manage those issues at all stages of operations.

Corporate structure
A key characteristic of a modern sustainable business is a clear focus on sustainability in the corporate strategy. The senior management team of an organisation needs to include environmental considerations in all aspects of the business and create policies that embody broad sustainability principles. Clear management responsibilities and commitment at the highest level are seen as vital in order to integrate environmentally responsible and sustainable management practices into all operations within a company, from exploration, through design and construction to mining, minerals processing, waste disposal, mine site rehabilitation and decommissioning. Usually staff are assigned with environmental responsibilities and report directly to senior management. This can be done by embedding environmental goals into the job descriptions of managers as well as appointing some staff to focus exclusively on sustainability and/or environmental issues. In particular, as recommended by the IMMS code, a senior executive environmental manager should be appointed to monitor the company’s marine mining activities, products or services, as well as monitoring internal environmental performance targets and communicating these to employees and sub-contractors. Both internal initiatives and external advice can be used for development, implementation and refinement of sustainability strategies actions and indicators. An environmental management structure that formalises reporting is often used in allied industries to improve sustainability across operations. This is particularly critical when mining companies become larger and environmental initiatives need to be maintained across multiple projects or divisions.

Corporate transparency is important in improving sustainability, both within and outside the company. The resulting increase in scrutiny provides the business case for sustainability and enhances innovation. This is vital for public companies that are obliged to report to investors and disclose everything "material" (i.e. the information that a reasonable investor would consider important in making an investment decision). Integrated reporting is becoming more common, in which sustainability metrics are included in annual financial reports. The International Integrated Reporting Framework (International Integrated Reporting Council 2013) sets out guidelines for this. Reports and performance metrics should encourage sustainability and efforts should be made to quantify and monitor environmental impacts. Reporting initiatives such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), Savings on Investment (SOI) and the
Shared Value Initiative should be encouraged. A long-term focus is also important for sustainability. As a result reporting and metrics that focus on the short term should be avoided, for example quarterly profit reports.

During the periodic review of environmental performance key areas for improvement should be identified and specific actions should be defined to increase sustainability. This may be done through function or issue-related policies, which are disseminated internally — through training, corporate communication or inclusion in staff evaluations — and externally — through sustainability reporting or marketing. Sustainability policies should be regularly reviewed and updated.

**Operational Management Systems (OMS)**

A company’s operating management system (or similar) is typically a company or company-wide framework aimed at helping it to manage risks (to personnel, local communities, the environment, assets and reputation) in its operating activities. ‘Operating’ usually covers every type of upstream or downstream activity, from construction to decommissioning, and throughout the value chain of the business. The operating management system brings together a company’s needs and internal standards on a range of matters such as health and safety, security, environment, social responsibility and operational reliability. Operating management systems are commonplace in the oil and gas industry, for example the Operations Integrity Management System (Exxon Mobil), Operating Management System (BP) and Operational Excellence Management System (Chevron). There are established guidelines for creation of OMS for offshore industry (International Association of Oil & Gas Producers & International Petroleum Industry Environmental Conservation Association 2014).

The fundamental requirements of operating management systems are to establish a system of leadership with a clear commitment to risk management and accountability. The OMS system starts by assessing the required elements and content of the management system, of which managing environmental risks is a key part. For a successful OMS to be developed the organization needs to establish its current position and future aspirations. OMS is a tool to standardize operations across multiple business units or projects to ensure best-practice approaches are followed in all areas. In addition to this, it ensures that a multi-staged plan-check-do approach to operations is carried out across the company’s activities and allows the auditing of activities for compliance against consistent standards. This process should lead to consistent operations and facilitates continuous improvement and knowledge sharing.
The degree of integration and the scope and content of an operating management system is determined by individual companies and differs according to their activities, organisational structures and maturity of the component management systems.

Common required elements of the various operating management systems include:

- Leadership, addressing management approaches and structure, organisational commitment, and management review and accountability;
- Legal requirements and compliance with them;
- Health, safety, security and environmental management;
- Emergency response;
- Staff qualifications, competence and training;
- Contractor management;
- Event/incident/crisis management and learning;
- Process safety information;
- Process hazard analysis;
- Integrity and reliability of physical assets (operational controls, maintenance controls, QA/QC);
- Operating and safe working procedures;
- Establishing goals and targets that are specific, measurable, achievable, realistic and time bounded (also referred to as SMART);
- Risk management;
- Environmental management;
- Management of change;
- External and internal stakeholder communications;
- Operations integrity audit.

Drawing on the practices and experiences and likely future needs of its member companies, the International Association of Oil & Gas Producers & International Petroleum Industry Environmental Conservation Association (OGP-IPIECA) has produced guidance on developing a new, or improving an existing, operating management system (International Association of Oil & Gas Producers & International Petroleum Industry Environmental Conservation Association 2014). While an OMS covers all risks in a company and is well suited to large multinational organisations with many projects globally, similar but more specific systems for managing environment risks, Environmental Management Systems (EMS), can be more widely applied and are suitable for all organisations.

**Environmental Management Systems (EMS)**

Environmental Management Systems (EMSs) are a formal approach to integrate procedures and processes for the training of personnel, monitoring, summarizing, and reporting of
specialized environmental performance information to internal and external stakeholders of the company (Melnyk et al. 2003). EMS has an important role in improving overall corporate environmental performance (Corbett & Kirsch 2001) and many companies have implemented a formal, certified environmental management system. An international standard that covers EMS is ISO 14001 (Annex 37), which was introduced in 1996 as an effective tool to guide managers in the cost reduction potential of waste reduction (British Standards Institute 1996). ISO 14001 has been adopted by over 300,000 companies (ISO 2014). Essentially, ISO standards set out the basic, structural elements of an EMS (Sayre 1996, Melnyk et al. 2003) and enable management to:

- Establish an environmental policy appropriate to the organization, including a commitment to the prevention of pollution.
- Facilitate planning, controlling, and monitoring to ensure policies are complied with and remain appropriate for the organization.
- Identify the legislative requirements and environmental aspects of the organization’s products, services and activities to determine impact, significance, priorities, and objectives.
- Establish a program to implement policies and objectives with a disciplined process of evaluating and achieving target performance levels, while seeking improvements where appropriate.
- Develop management and employee commitment to the protection of the environment, with clear assignment of accountability and responsibility.
- Encourage environmental planning throughout the full range of the organization’s activities, from raw materials acquisition to product distribution.
- Provide resources, including training, to achieve targeted performance levels on an on-going basis.
- Establish a management process to review and audit the EMS and to identify opportunities for improvement of the system and resulting environmental performance.
- Establish and maintain appropriate communications with relevant internal and external parties.
- Encourage contractors and suppliers to establish an EMS.

The ISO 14001 EMS standards set out the process by which an EMS might be constructed. They are not specific performance standards or performance criteria. The ISO 14001 EMS standards do not mandate a particular organization’s optimum environmental performance level, but describe a system to help an organization achieve its environmental objectives (Melnyk et al. 2003). For ISO 14001, external verification is required in order to renew accreditation that accepted management systems are being used. An EMS can help organisations to manage day-to-day environmental impacts arising during the construction, operation and decommissioning of projects. EMS is used widely in offshore industries. For
example the oil and gas industry has developed a generic health, safety and environmental management system (E&P Forum 1994). Evidence suggests that having a formalized and certified EMS in place increases the impact of environmental activities on corporate performance, and is much better than informal and uncertified systems (Melnyk et al. 2003).

In Europe two other important standards for EMS exist: the OSPAR (Oslo Paris Commission) Recommendation 2003/5 (2003c) (Annex 38) and the European Eco-Management and Audit Scheme (EMAS) (Annex 39). The ISO 14001 EMS requirements are an integral part of EMAS. However, EMAS takes into account additional elements to support organisations that continuously improve their environmental performance. OSPAR Recommendations 2003/5 include elements for auditing and reporting. Contracting Parties to OSPAR are required to promote and encourage the use of management systems that are in accordance with the principles of internationally recognised standards, such as ISO 14001, by operators acting within their jurisdiction.

A company may have an overarching Health, Safety and Environmental (HSE) management system that governs all its activities or may have an umbrella system covering subsets of the HSE policy in different countries, for different business activities, or in relation to different management systems for different assets (e.g. different production platforms). The underlying principles should remain the same moving from a corporate company system to a country-level asset system, with only the level of detail and specificity changing.

In the offshore oil and gas sector, environmental management systems are nearly always a subset of, and are integrated with, health, safety and environmental management systems (or variants thereof). An HSE management system is a business process for systematically achieving a desired level of HSE performance. HSE management systems involve planning and implementing the necessary systems, programmes and procedures to achieve a desired level of performance, together with monitoring results and making adjustments as necessary, to ensure that the desired level of performance continues to be achieved. Examples of systems that might be used are provided for the oil and gas industry (E&P Forum 1994, E&P Forum / UNEP 1997). Formal Environmental Management Systems (EMSs) or Health, Safety and Environmental Management Systems (HSEMSs) of the nature of those developed in the oil and gas sector have generally not been developed in other offshore industries, such as the marine aggregate extraction industry.

From a Regulator’s perspective (in this case the UK Government’s Department of Energy and Climate Change, DECC, and its regulation of offshore oil and gas operations) environmental management systems are seen as a means for improving environmental performance in 1) setting a clear environmental policy and specific environmental goals, 2) setting out
objectives and targets to manage significant environmental impacts, 3) report on (as a minimum) oil and chemical releases, chemical use, waste generation and atmospheric emissions.

**Products of EMS**

An important outcome of an EMS is the development of a company sustainability vision and associated codes of practice to improve environmental performance. Within the MIDAS Consortium a good example of how individual companies approach corporate social responsibility may be seen in the Code of Conduct adopted by IHC Merwede BV (IHC) (Annex 1) (IHC Merwede B.V. 2014). The Code has 6 major elements applying to 1) employees, 2) business integrity, 3) human rights and society, 4) the environment, 5) the supply chain and 6) data privacy. In terms of environmental accountability IHC seeks to use and develop green technologies to reduce environmental impacts over the entire life cycle of its products and operations and to comply with all environmental legislation.

In terms of actual deep-sea mining the only example of the development of a company corporate social responsibility charter is by Nautilus Minerals for its proposed deep-sea mining activities in waters within the EEZ of Papua New Guinea (Annex 41) (Nautilus Minerals 2015). A dedicated website, Nautilus CARES (Community Accountable, Responsible Environmentally, Safe), was created to report and stimulate feedback on social, environmental and safety issues. Although no communities were affected directly by the mine site at a depth of 1600m, a series of engagements with local people in association with the provincial governments were carried out, including the production of brochures in Tok Pisin, the Local language, and face-to-face meetings. Significant investment has been made in the education and training of indigenous peoples, as well as provisions for improving the quality of life. In environmental work the company engaged a number of different scientific institutions to conduct the work for an Environmental Inception Report, Environmental Impact Assessments and an Environmental Impact Statement, all reported openly on the company’s web pages.

**Gaps and areas for development of protocols and standards**

Several important gaps and areas for development of protocols and standards have been identified in this review. These are listed below. All the standards and protocols will evolve as the regulations improve and the first mining projects go through the system. It is
important for the developing industry to continually revisit and improve standards and protocols based upon the experience they gain as a result of operations.

Environmental Management

- Systems for minimizing environmental impact at the engineering and design phase of mining equipment
- Protocols for reducing environmental impacts during mining operations. These would include design of mining track pattern, the creation of unmined areas, such as patches / corridors, control of discharge timings, soft starts (limit disturbance during the start-up of operations for example by operating on reduced power) etc.
- Indicators for assessing good environmental quality;
- Thresholds and other triggers for action,
- Transparency standards
- Protocols for identification of stakeholders for deep-sea mining projects
- Assessment of corporate structure to include senior staff with responsibility for Health, Safety and Environment (HSE)

SEA and EIA
- Protocols for scoping a mining EIA (Determining the extent of issues to be considered in the assessment and reported in the Environmental Statement; although see ISBA/16/LTC/7)
- Guidance on conducting strategic environmental assessment for deep-sea mining plans, policies, programmes or technologies
- Data standards for mining (to facilitate data collation by the regulator)
- Protocols for evaluation of environmental impact assessments by regulators
- Guidance for evaluating cumulative and multi-sectoral impacts
- Guidance for developing regional scale environmental management plans and for linking them into regulations, environmental management plans as well as best practice standards

Baseline assessment and monitoring
• Standards for biodiversity data collection in low-density abyssal area – survey design, effort, equipment etc.

• Standard approaches for measuring and comparing environmental impact (indicators)

• Protocols for evaluation of pelagic fauna

• Standard approaches for defining Good Ecological Status in areas proposed for mining activities

• Protocols for design of regional networks of no-mining areas including the identification of VMEs and critical marine habitat and the use of biogeographic classification tools to determine “representativeness”

• Protocols for the protection of vulnerable marine ecosystems and other sensitive areas inside mining areas

• Protocols for assessment of the impacts of sedimentation and plumes on all ecosystem components

The nature of developed environmental standards is very important. While well-designed approaches can improve environmental conditions, poorly designed standards can quickly become out-of-date, suppress innovation and ultimately lead to reductions in sustainability of operations. If environmental standards are to foster innovations that might arise from new technologies and approaches to production, they should adhere to three principles (Porter & van der Linde 1995). First, they must create the maximum opportunity for innovation, leaving the approach to innovation to industry and not the standard-setting agency. Second, regulations should foster continuous improvement, rather than locking in any particular technology. Third, the regulatory process should leave as little room as possible for uncertainty at every stage. Market-based and flexible approaches such as emissions taxes or tradable allowances, or performance standards, are more favorable to innovation than prescriptive technological standards, because they leave more freedom to industry on the technological solution to minimize compliance costs (Porter & van der Linde 1995).

Conclusions
It is clear that there is a pressing need for environmental management of the deep-sea mining industry. There are already much international and national legislation in place that stipulates key environmental management principles and requirements. There is also substantial pressure from both direct and indirect stakeholders for procedures to be put in place that reduce the magnitude and likelihood of environmental risks. In many cases the regulator for deep-sea mining activities is clear and they have some procedures in place that are being developed and updated regularly.

Several important gaps and areas for development of protocols and standards have been identified in this review. These include standards for environmental management, SEA and EIA and baseline assessment and monitoring. More specifically, identified gaps include reducing impacts during the design and operation phase of mining, providing robust indicators of impacts and thresholds, transparency standards, optimal corporate structuring for sustainability, scoping EIAs, developing SEAs, data standards, assessing cumulative and multi-sectoral impacts, developing regional environmental management plans, standards for baseline biodiversity data collection, approaches for defining good ecological status, design and protection of protected areas and assessment of the impacts of plumes.

There are a well-developed set of tools for reducing the environmental impacts of industry that can be applied to deep-sea mining. In some cases these have been tested for imminent projects; e.g. the Solwara 1 development has already undertaken an environmental impact assessment. In other cases it is not clear how some tools, for example strategic environmental assessment, will be implemented in the case of deep-sea mining. Currently the deep-sea mining industry is small and facing much international scrutiny. As a result environmental impacts and the sustainability of the industry will be high on the corporate agenda. As the industry develops and becomes larger, potentially with companies managing multiple projects across the world, environmental management may become more difficult and critical. Lessons from the offshore oil and gas industry in creating systems for both organizational and environmental management will help reduce environmental impacts and risks. It is important to act now in developing and reviewing the guidance for this fledgling industry because standards and protocols set at the outset quickly become precedents. Using the lessons learned from other marine policy and allied industries coupled with scientific advances in understanding of the deep sea mean that clear, robust and precautionary protocols and standards can be developed to guide the deep-sea mining industry as it develops.
(1992a) Convention on Biological Diversity entered into force 1993 I-30619; UNTS 1760
(2003c) OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry
(2003d) Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context
E&P Forum (1994) Guidelines for the development and application of health, safety and environmental management systems
International Finance Corporation (2012) IFC Performance Standards on Environmental and Social Sustainability
International Seabed Authority (2009) Regulations on prospecting and exploration for cobalt-rich ferromanganese crusts in the Area, ISA Legal and Technical Commission document ISBA/16/C/WP.2, Kingston, Jamaica
International Seabed Authority (2010) Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for polymetallic nodules in the Area, ISA Legal and Technical Commission document ISBA/16/LTC/7, Kingston, Jamaica
International Seabed Authority (2012) Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for polymetallic sulphides in the Area, ISA Legal and Technical Commission document ISBA/18/LTC/6, Kingston, Jamaica
Nautilus Minerals (2015) Nautilus Cares (Community Accountable, Responsible Environmentally and Safe)
New Zealand Environmental Protection Authority (2014) Trans-Tasman Resources Ltd Marine Consent Decision, New Zealand Government
New Zealand Environmental Protection Authority (2015) Decision on marine consent application by Chatham Rock Phosphate Limited to mine phosphorite nodules on the Chatham Rise, New Zealand Government
The International Association of Oil & Gas Producers (2012) Geomatics Guidance Note number 7, part 1
United Nations Economic and Social Council (2005) Decision II/4 promoting the application of the principles of the Aarhus Convention international forums ECE/MPPP/2005/2/Add5 adopted at the second meeting of the Parties held in Almaty, Kazakhstan, on 25-27 May 2005

Vidal J (2015) ‘I drank the water and ate the fish. We all did. The acid has damaged me permanently’ The Guardian, London
Annexes


Introduction: In contrast to the open access nature of the high seas, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) declared the seabed area beyond national jurisdiction (the Area) and its mineral resources as the “common heritage of mankind”, to be administered by the International Seabed Authority (ISA or the Authority) for the benefit of mankind as a whole. All mineral exploration and exploitation activities must be sponsored by a State Party to UNCLOS and approved by the ISA. In its 21 years of existence, the ISA has adopted regulations and guidance for exploration activities; in 2013 it commenced the development of regulations to govern the future exploitation of seabed minerals.

Common heritage of mankind: UNCLOS in Part XI, together with its 1994 Implementation Agreement relating to Part XI, sets forth the international legal framework for activities related to deep seabed mining and marine scientific research in the Area. The guiding principle of the common heritage of mankind is manifested in many ways:

- All rights in the resources of the Area are vested in mankind as a whole
- No State or natural or juridical persons can claim, acquire or exercise rights in connection to resources in the Area except in accordance with Part XI
- All mining and any minerals recovered may only be alienated in accordance with UNCLOS and the rules adopted by the ISA
- States are required to ensure that they exercise “effective control” over any activities by their state enterprises and other natural or juridical persons they sponsor
- Activities in the Area, including marine scientific research, are to be carried out for the benefit of mankind as a whole
- Financial and other economic benefits from seabed mining are subject to equitable sharing under rules to be developed by the ISA (UNCLOS articles 133-143).

Environmental requirements: UNCLOS further requires that necessary measures shall be taken to ensure effective protection for the marine environment from harmful effects which may arise from mining-related activities. The ISA under UNCLOS article 145 is to adopt appropriate rules, regulations and procedures to *inter alia*:

a) Prevent, reduce and control pollution and other hazards to the marine environment, including the coastline, which have the potential to interfere with the ecological balance of the marine environment. In doing this, its mandate calls for particular attention to be paid to the need for protection from the harmful effects of such activities as drilling, dredging, excavating, disposing of waste, and constructing and operating or maintaining installations, pipelines and other devices related to such activities

b) Protect and conserve the natural resources of the Area, preventing damage to the flora and fauna of the marine environment.

Environmental standards relevant for seabed mining will also be informed by the obligations in Part XII of UNCLOS on Protection of the Marine Environment, including the general obligation to protect and preserve the marine environment (UNCLOS article 192). Part XII of UNCLOS includes responsibilities to prevent, reduce and control pollution of the marine environment from any source,
to monitor the risks or effects of pollution and to assess the potential effects of activities under States parties jurisdiction and control that may cause substantial pollution of or significant and harmful changes to the marine environment. (UNCLOS articles 204-206). In particular, States parties must take measures to protect and preserve rare or fragile ecosystems, as well as the habitats of depleted, threatened or endangered species and other forms of marine life (UNCLOS article 194.5). They must also prevent, reduce and control pollution resulting from the use of technologies under their jurisdiction or control and the intentional or accidental introduction of alien or new species to a particular part of the marine environment (UNCLOS article 196.1).

Pollution requirements: Of particular relevance to deep seabed mining is art. 194 (3) (d), which provides that States shall take measures to minimize the fullest possible extent pollution from installations and devices in exploration or exploitation of the natural resources of the seabed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea and regulating the design, construction, equipment, operation and manning of such installations or devices.

UNCLOS further requires that national rules for pollution from seabed activities in the Area as well as within national jurisdiction to be no less effective than international rules, standards and recommended practices and procedures (UNCLOS articles 208-209).


The 1994 Agreement reaffirms the responsibilities detailed by UNCLOS (the Convention) by establishing “the importance of the Convention for the protection and preservation of the marine environment and of the growing concern for the global environment” and goes on to state that between the entry into force of the Convention and the approval of the first work plan for exploitation, the ISA shall concentrate on, inter alia, the “Adoption of rules, regulations and procedures incorporating applicable standards for the protection and preservation of the marine environment”. (Implementing Agreement, annex, section 1, para. 5 (f))

Institutions: The main organs for the ISA are the Assembly, the Council, the Legal and Technical Commission (LTC), the Finance Committee and the Secretariat. The Assembly consists of all member States and elects officers (Chairs, Secretary-General etc.) and sets the general policies for the Authority. The Council consists of 36 member States which are elected by the Assembly based on varying economic interests and geographic representation. The Council acts as the executive organ and discusses substantive matters. The LTC reviews inter alia applications for approval of a plan of activities in the Area, supervises the contractors and drafts rules and regulations for submission to the Council.

Regulation of Exploration for Deep Sea Minerals in the Area
Regulations and recommendations adopted by the Authority to govern exploration for deep sea minerals in the Area include:

- Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (ISBA/6/A/18, 13 July 2000, as amended by ISBA/19/A/9 and ISBA/19/A/12, 25 July 2013, and ISBA/20/A/9, 24 July 2014)
• Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area (ISBA/16/A/12/Rev.1, 15 November 2010, as amended by ISBA/19/A/12, 25 July 2013)
• Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area (ISBA/18/A/11, 27 July 2012, as amended by ISBA/19/A/12, 25 July 2013)
• Environmental Management Plan for the Clarion-Clipperton Zone, 2011 and 2012
• Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area, as amended in 2013.

The three sets of regulations for the different mineral resources (polymetallic sulphides, polymetallic nodules and cobalt-rich ferro-manganese crusts) are broadly similar in format, scope and content. Any differences between the regulations reflect primarily the different spatial and geological characteristics of the mineral resources.

It is worth noting the expectation that the LTC will develop and implement procedures for determining, on the basis of the best available scientific and technical information, whether proposed exploration activities would have “serious harmful effects on vulnerable marine ecosystems, in particular those associated with [hydrothermal vents/seamounts and cold water corals],” and ensure that “if it is determined that certain proposed activities would have serious harmful effects on vulnerable marine ecosystems” that those activities are managed to prevent such effects or not authorized to proceed.

The regulations for polymetallic nodules are explored in greater detail in Annex 11, and act as a proxy for the content of the regulations for polymetallic sulphides and cobalt-rich crusts.
Annex 2. CBD Voluntary Guidelines for the consideration of Biodiversity in Environmental Impact Assessments and Strategic Environmental Assessments in Marine and Coastal Areas

Approved in UNEP/CBD/COP/DEC/XI/18; Guidelines found at UNEP/CBD/COP/11/23

**Purpose:** The CBD Guidelines are intended to inform the implementation of environmental impact assessments (EIAs) and strategic environmental assessments (SEAs) for activities which may have significant adverse impacts with a view to ensuring that such activities “do not compromise ecosystem integrity”.

**Status:** The CBD Guidelines were not officially adopted (as some States felt their comments had not been adequately reflected) but rather “noted” by the CBD Conference of Parties. They are not binding.

**Function:** Parties to the Convention on Biological Diversity, other Governments and competent organizations (eg the ISA), in accordance with national and international law, including the United Nations Convention on the Law of the Sea, are “encouraged” to apply the voluntary guidelines.

**Approach:** The Voluntary Guidelines for EIAs for marine and coastal areas are in fact annotations of more generic CBD Voluntary Guidelines for biodiversity-inclusive EIAs

**Key elements:** of CBD EIA Guidelines for Marine and Coastal Areas
- Introduction
- Stages in the process
- Biodiversity Issues at different stages of the process
- Appendix 1 – Indicative Set of Screening Criteria for EIAs for Marine and Coastal Areas
- Appendix 2 – Indicative List of Ecosystem Services for Marine and Coastal Areas
- Appendix 3 – Aspects of Biodiversity: Composition, Structure and Key Processes

**Scoping:** May be more challenging for areas beyond national jurisdiction (ABNJ).
- Relevant stakeholders include global and regional organizations as well as national authorities and communities.
- The scoping process is likely to draw on a wider pool of expertise, which includes global and regional experts as well as national experts on the potential impacts of the relevant activity.

**Assessment and evaluation of impacts**
- Efforts should be made to incorporate latest works on ecosystem services and values
- Be prepared for paucity of data, hence application of a precautionary approach will be particularly important
- Greater need for information gathering through scientific assessments, surveys and modelling to describe ecologically or biologically significant areas\(^1\) and other important features\(^2\)

\(^1\) CBD scientific criteria for ecologically or biologically significant areas (EBSAs) (annex I, decision IX/20)
1. Uniqueness or Rarity
2. Special importance for life history stages of species
• Greater dependence on incremental and iterative “test-based” approaches

**Pertinent questions from biodiversity perspective**

- Would the intended activity affect the protection of habitats of importance for **threatened, endangered or declining species**, or **cause changes to biological or ecological processes** that may affect such species?
- Would the activity have the potential to cause **significant adverse impacts**? It should be possible to build on the criteria for “significant adverse impacts” developed in the FAO International Criteria for Management of Deep-Sea Fisheries in the High Seas.3
- **Ecosystem Diversity**: Would the intended activity lead to damage to (an) ecosystem(s), thus leading to a loss of ecosystem services?
- **Species Diversity**: Would the intended activity cause a loss of a population of species?
- **Genetic Diversity**: Would the intended activity result in extinction of a population of species of scientific, ecological, or cultural value?

For consideration of mitigation or enhancement measures:

- **Stakeholders**: “For EIs of activities affecting marine biodiversity in areas beyond national jurisdiction, the public is the global community. Considerations of equity in distribution of socio-economic benefits and in allocating environmental costs, and building a consensus on the appropriate balance of those costs and benefits in EIs are challenging for marine and coastal areas, and in particular in marine areas beyond national jurisdiction, both because of the difficulty in identifying relevant stakeholders and because the “environment” of marine areas beyond national jurisdiction may be on a basin-wide or global scale rather than local or national.
- **Adaptive approaches**: However, the knowledge that can be gained from an industry operating in an area of limited knowledge can be a benefit that needs to be taken into account, particularly when the scale of the commercial activity can be kept small enough initially that the risk of significant adverse impacts is low to the extent that such information is made freely available, and is unbiased and independently verifiable. Significant knowledge can also be gained through the assessment process itself.”

**Limited knowledge and ability**: Determining whether biophysical changes are likely to have adverse impacts: “In open-ocean waters and deep-sea habitats, there is a particular concern about the limited ability to predict indirect adverse impacts”

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3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, Fragility, Sensitivity, or Slow recovery
5. Biological Productivity
6. Biological Diversity
7. Naturalness

2 For criteria for Vulnerable marine ecosystems see: FAO International Guidelines for Management of Deep Sea Bottom Fisheries in the High Seas, paragraphs 14 and 42 (below)
3 For criteria for “significant adverse impacts” see FAO International Guidelines for Management of Deep Sea Bottom Fisheries in the High Seas, paragraphs 17-20 (below)
Paragraph 25 (page 12-14) provides a sequence of questions for typical biodiversity inclusive EIAs to respond to, accompanied by commentary on their application in the deep sea and open ocean. These may need to be carefully scrutinized. (see extract below)

Paragraph 27 provides a number of practical recommendations for EIAs addressing biodiversity related issues, with commentary on their application in deep seabed and open ocean habitats (see extract below).

Note on Stakeholders and Participation: Impact assessment is concerned with (i) information, (ii) participation, and (iii) transparency of decision-making. Public involvement consequently is a prerequisite for effective EIA and can take place at different levels: informing (one-way flow of information), consulting (two-way flow of information), or “real” participation (shared analysis and assessment). Public participation is relevant in all stages of EIA.

Special Biodiversity Considerations: Consequences of less knowledge
- Great challenges in quantifying sustainable levels of impacts
  - Setting baselines and benchmarks is difficult –
  - Documenting drivers of past change is often difficult
- Outlines need for greater reliance on models & extrapolation
  - Less experience in how to bound extrapolations
  - Less independent data to test / validate models
  - Lack of knowledge underlines importance of precautionary approach

Appendix 2 INDICATIVE LIST OF ECOSYSTEM SERVICE, contains a very useful list of regulating, provisioning, cultural and other services related to the seabed

Appendix 3 on ASPECTS OF BIODIVERSITY: COMPOSITION, STRUCTURE AND KEY PROCESSES identified specific elements of biodiversity and notes what these are influenced by.
- Composition: Minimal viable population of …
- Structure: changes in spatial or temporal structure and how these might be influenced
- Food web structure and interactions
- Presence of keystone species
- Key processes: In the marine context the effect on the status of keystone species needs to be considered over the scale of the area of concern. Specialized ecological knowledge is required.

[bolded text is how the Guidelines specifically address open ocean and deep sea habitats; the bold is in the original]

2. Scoping

25. The following sequence of questions provides an example of the kind of information that should be requested in the terms of reference for an EIA if the project screening suggests that the proposed activity is likely to have adverse impacts on biodiversity. This list of steps represents an iterative process. Scoping and impact study are two formal rounds of iteration; during the study further iterative rounds may be needed, for example when alternatives to the proposed project design have to be defined and assessed:

   (a) Describe the type of project, and define each project activity in terms of its nature, magnitude, location, timing, duration and frequency;

   (b) Define possible alternatives, including “no net biodiversity loss” or “biodiversity restoration” alternatives (such alternatives may not be readily identifiable at the outset of an EIA, and one would need to go through the EIA to determine such alternatives). Alternatives include location alternatives, scale alternatives, siting or layout alternatives, and/or technology alternatives. Where response times of some ecosystem components to restoration are slower, restoration may be viewed as a less attractive option, in addition, the less complete knowledge on both ecosystem dynamics and often shorter history of and more limited experience with many types of commercial or large-scale research activities in marine areas, in particular in open-ocean waters and deep-sea habitats, mean that there often are fewer technology alternatives that have been developed already (a negative consideration) but the potential to develop new alternatives may be large (a positive consideration); On the other hand, the large spatial scale of many marine ecosystems makes relocation of some types of activities more feasible because there is a wider range of areas from which to choose;

   (c) Describe expected biophysical changes (in water, air, flora, fauna) resulting from proposed activities or induced by any socio-economic changes caused by the activity. For EIAs of activities affecting marine and coastal biodiversity, in particular in open-ocean waters and deep-sea habitats, there could be less knowledge of biophysical changes, including the risk of extinction or even of factors which affect risk of extinction and in which ways they affect the risk of extinction than for terrestrial ecosystems. In addition, recovery times from perturbations in those areas are usually at best incompletely known;

   (d) Determine the spatial and temporal scale of influence of each biophysical change, identifying effects on connectivity between ecosystems, and potential cumulative effects. These determinations could be more difficult for marine and coastal biodiversity in many areas, particularly in open-ocean waters and deep-sea habitats, than for terrestrial biodiversity because of the size and variability of the temporal and spatial scales involved, the variety and patchiness of the habitats and communities, in the water column, on the seabed and below the seabed, the importance of connectivity between marine ecosystems, and the incomplete and sometimes absence of data on all of these elements;

   (e) Describe ecosystems and water column and seabed-use types lying within the range of influence of biophysical changes. For marine biodiversity, knowledge of ecological relationships...
is more limited than for terrestrial biodiversity. However, there is potential for substantial progress in improving our bio-geographic classifications and mapping of patterns of historical human activities in marine and coastal areas through the EIA process;

(f) Determine, for each of these ecosystems or water column and seabed-use types, if biophysical changes are likely to have adverse impacts on biodiversity in terms of composition, structure (spatial and temporal), and key processes. Give indication of the level of certainty of predictions, and take into account mitigation measures. Highlight any irreversible impacts and any irreplaceable loss. For marine and coastal biodiversity, knowledge of all these factors is likely to be more limited than for terrestrial biodiversity. In open-ocean waters and deep-sea habitats, there is a particular concern about the limited ability to predict indirect adverse impacts;

(g) For the affected areas, collect available information on baseline conditions and any anticipated trends in biodiversity in the absence of the proposal. For most marine areas, particularly open-ocean waters and deep-sea habitats, there is little capability to do this at present. Very few of these areas have been affected so far and few data exist on conditions prevailing prior to human activities that may have already caused undocumented changes. The large spatial scale of many species’ distributions and their migratory and dispersal patterns are useful factors, however, because information may be extrapolated and integrated over large scales for some ecosystem components;

(h) Identify, in consultation with stakeholders, the current and potential ecosystem services provided by the affected ecosystems or water column and seabed-use types and determine the values these functions represent for society (see box 1). Give an indication of the main beneficiaries and those adversely affected from an ecosystem services perspective, focusing on vulnerable stakeholders. This guideline may be challenging to implement for marine biodiversity in areas beyond national jurisdiction because of the difficulties involved in identifying the relevant stakeholders and stakeholder as discussed in guideline 5 (b) above;

(i) Determine which of these services will be significantly affected by the proposed project, giving confidence levels in predictions, and taking into account mitigation measures. Highlight any irreversible impacts and any irreplaceable losses. For marine and coastal biodiversity, and in particular for biodiversity in open-ocean waters and deep-sea habitats, knowledge limitations in relation to ecological systems will make this guideline difficult to implement;

(j) Define possible measures to avoid, minimize or compensate for significant damage to, or loss of, biodiversity and/or ecosystem services; define possibilities to enhance biodiversity. Make reference to any legal requirements. This guideline may also be challenging to implement for marine biodiversity, particularly in areas beyond national jurisdiction, because of the difficulties involved in identifying appropriate compensation for breach of the duty to prevent significant adverse impacts; UNCLOS sets out rules on responsibilities and liability in relation to various activities in the marine environment;

(k) Evaluate the significance of residual impacts, i.e., in consultation with stakeholders define the importance of expected impacts for the alternatives considered. Relate the importance of expected impacts to a reference situation, which may be the existing situation, a historical situation, a probable future situation (e.g., the ‘without project’ or ‘autonomous development’ situation), or an external reference situation. When determining importance (weight), consider geographic importance of each residual impact (e.g., impact of local/regional/national/continental/global importance) and indicate its temporal dimension. This guideline may be challenging to implement
for marine areas beyond national jurisdiction because of the difficulties involved in identifying the relevant stakeholders and stakeholder fora discussed in guideline 5 (b) above;

(l) Identify necessary surveys to gather information required to support decision-making. Identify important gaps in knowledge. The feasibility of filling gaps quickly to improve the basis for decision-making is often lower in marine and coastal areas compared to terrestrial areas, and particularly so in open-ocean waters and deep-sea habitats for logistical reasons, including the high cost of gathering such information in remote locations and the more restricted availability of national, regional or global resources to perform such tasks. However, it may be possible to make better use of existing information to create models and develop proxies, as well as to commission site-specific studies to ground-truth models, in a timely and cost effective way;

(m) Provide details on required methodology and time scales.

27. An analysis of current impact assessment practice in terrestrial and coastal areas has provided a number of practical recommendations when addressing biodiversity-related issues. To date, only a small proportion of this practice, except for some fishing impact assessments, has related to impacts of human activities in marine areas, but there is an expectation that guidance on EIAs in these areas will evolve as experience is gained;

(a) Beyond the focus on protected species and protected areas, further attention must be given to (i) sustainable use of ecosystem services; (ii) ecosystem-level diversity; (iii) non-protected biodiversity; and (iv) ecological processes and their spatial scale. For marine and coastal areas, the scientific criteria for identifying "ecologically or biologically significant areas" (EBSAs), and similar criteria such as the FAO criteria for "vulnerable marine ecosystems" (VMEs) may be relevant;

(b) The terms of reference should be unambiguous, specific and compatible with the ecosystem approach; too often, the terms of reference are too general and impractical. This could be challenging for EIAs of activities affecting marine biodiversity that involve large spatial and temporal scales. In such cases, it is unlikely that important ecosystem services could be mapped on scales that are relevant to such a precise application of the ecosystem approach. The ecosystem approach is better applied in a more generic way in these areas. The scientific criteria for identifying "ecologically or biologically significant areas" (EBSAs), and similar criteria such as the FAO criteria for "vulnerable marine ecosystems" (VMEs) may be relevant;

(c) In order to provide a sound basis for assessing the significance of impacts, baseline conditions must be defined and understood and quantified where possible. Baseline conditions are dynamic, implying that present and expected future developments if the proposed project is not implemented (autonomous development) need to be included. This may be particularly difficult to apply to EIAs of activities affecting marine biodiversity in open-ocean waters and deep-sea habitats because of the relatively limited knowledge of ecosystems and their relationships, and hence the need to develop a sound basis for assessing what constitutes significant and harmful changes to the marine environment;

(d) Field surveys, quantitative data, meaningful analyses, and a broad, long-term perspective enabling cause-effect chains to be tracked in time and space are important elements when assessing biodiversity impacts. For EIAs of activities affecting marine biodiversity, in particular in open-ocean waters and deep-sea habitats, the knowledge limitations already discussed with regard to ecosystems and their relationships become even more important when there is a requirement to track cause-effect chains in space and time. This may not be possible for
some time to come for most ecosystems in these areas. Potential indirect and cumulative impacts need to be better assessed and understood;

(e) Alternatives and/or mitigation measures must be identified and described in detail, including an analysis of their likely success and realistic potential to offset adverse project impacts. For EIAs of activities affecting marine and coastal biodiversity, particularly in open-ocean waters and deep-sea habitats, the implementation of this guideline could be hampered by the knowledge limitations on ecosystems and their relationships;

(f) Guidance for scoping on biodiversity issues in EIA must be developed at national level, but should, where appropriate, also consider regional aspects, to reduce and preferably prevent transboundary impacts. For EIAs of activities affecting marine biodiversity in areas beyond national jurisdiction, scoping of issues at a regional, rather than a national, scale may be the usual starting point. Global guidance will also be relevant to the regional scale of scoping;

(g) Guidance for determining levels of acceptable change to biodiversity must be developed at national level to facilitate decision-making. For EIAs of activities affecting marine biodiversity in areas beyond national jurisdiction, guidance for determining levels for acceptable change could be more difficult to establish. These need to be developed at the global and where applicable at the regional scale. Given the many knowledge limitations with regard to ecosystems and their relationships in marine and coastal areas, making case-by-case evaluations may be challenging;

(h) Guidance on assessing and evaluating impacts on ecosystem processes, rather than on composition or structure, must be developed at national level. The conservation of ecosystem processes which support composition and structure requires consideration of a substantially larger proportion of the landscape than is required to represent biodiversity composition and structure. “Landscape” here would refer to “coastal and marine ecosystems”. For marine biodiversity in areas beyond national jurisdiction, the comments in sub-paragraph 27(g) on global, and where applicable regional, rather than national levels for guidance may also apply here. Knowledge limitations regarding ecosystem processes and services in marine and coastal areas also apply, so in practice evaluation of impacts will usually be of composition and structure, with any evaluation of impacts on processes only inferred indirectly;

(i) Capacity development is needed to effectively represent biodiversity issues in the scoping stage; this will result in better guidelines for the EIA study. Capacity-building needs for EIAs relating to activities in open-ocean waters and deep-sea habitats are likely to be larger than capacity-building needs for coastal waters and habitats. In marine areas beyond national jurisdiction, “customs of practice” for EIA are less well established, methodologies are less mature and multiple assessment cultures may converge in the same area. Nonetheless experience with EIAs is growing with respect to bottom fishing, waste dumping and deep-sea mineral exploration and the effects of fishing on seabirds and other marine animals that may become helpful for future capacity development.

3. Assessment and evaluation of impacts, and development of alternatives

28. EIA should be an iterative process of assessing impacts, re-designing alternatives and comparison. The main tasks of impact analysis and assessment are:

(a) Refinement of the understanding of the nature of the potential impacts identified during screening and scoping and described in the terms of reference. This includes the identification of indirect and cumulative impacts, and of the likely cause–effect chains;
(b) Identification and description of relevant criteria for decision-making can be an essential element of this stage;

(c) Review and redesign of alternatives; consideration of mitigation and enhancement measures, as well as compensation of residual impacts; planning of impact management; evaluation of impacts; and comparison of the alternatives; and

(d) Reporting of study results in an EIS or EIA report.

29. Assessing impacts usually involves a detailed analysis of their nature, magnitude, extent and duration, and a judgement of their significance, i.e., whether the impacts are acceptable to stakeholders and society as a whole, require mitigation and/or compensation, or are unacceptable.

30. Available biodiversity information is usually limited and descriptive, and cannot be used as a basis for numerical predictions. There is a need to develop biodiversity criteria for impact evaluation and measurable standards or objectives against which the significance of individual impacts can be evaluated. The priorities and targets set in the National Biodiversity Strategy and Action Plan process or a comparable regional process in regional sea organizations or regional fisheries management organizations for marine areas beyond national jurisdiction can provide guidance for developing these criteria. Tools will need to be developed to deal with uncertainty, including criteria on using risk assessment techniques, precautionary approach and adaptive management.

31. A number of practical lessons with respect to the study process have emerged, including that the assessment should:

(a) Allow for enough survey time to take seasonal features into account, where confidence levels in predicting the significance of impacts are low without such surveys. For EIAs of activities affecting marine and coastal, in particular in open-ocean waters and deep-sea habitats, multiple surveys may not be feasible logistically or financially, so strategies to make the best use of existing information, to build models and develop proxies, together with a survey, may need to suffice. Incremental and carefully controlled and monitored industry activities may be an alternative in some cases;

(b) Focus on processes and services, which are critical to human well-being and the integrity of ecosystems. Explain the main risks and opportunities for biodiversity. For EIAs of activities affecting marine and coastal biodiversity, practical options could focus on EBSA-like properties rather than processes and services;

(c) Apply the ecosystem approach and actively seek information from relevant stakeholders and indigenous and local communities. For EIAs of activities affecting marine and coastal biodiversity, in particular in open-ocean waters and deep-sea habitats, often an industry operating in these areas such as fisheries, shipping or deep seabed mining will be more likely to be a source of information than local communities. In addition the ecosystem approach is better applied in a more generic way. Address any request from stakeholders for further information and/or investigation adequately. This does not necessarily imply that all requests must be honoured; however, clear reasons should be provided where requests are not honoured;

(d) Consider the full range of factors affecting biodiversity. These include direct drivers of change associated with a proposal (e.g., disturbance, introduction of invasive alien species or genetically modified organisms, etc.) and, to the extent possible, indirect drivers of change, including demographic, economic, socio-political, cultural and technological processes or interventions;
(e) Evaluate impacts of alternatives with reference to the baseline situation. Compare against legal standards, thresholds, targets and/or objectives for biodiversity. Use national biodiversity strategies and action plans and other relevant documents for information and objectives. The vision, objectives and targets for the conservation and sustainable use of biodiversity contained in local plans, policies and strategies, as well as levels of public concern about, dependence on, or interest in, biodiversity provide useful indicators of acceptable change. This guideline will be challenging to apply for EIAs of activities affecting marine and coastal biodiversity, particularly in areas beyond national jurisdiction, due to all the previously discussed issues with setting baselines and reference levels for the high seas and seabed area, the lack of biodiversity strategies and action plans for such areas, the differences in the implementation of flag States’ obligations, and the array of competent international organizations;

(f) Take account of cumulative threats and impacts resulting either from repeated impacts of projects of the same or different nature over space and time, and/or from proposed plans, programmes or policies; In marine and coastal areas, including in open-ocean waters and deep-sea habitats, it may also be necessary to consider the cumulative effect of environmental changes such as climate change and ocean acidification that may shift the location or timing of key ecological processes and features, as well as impose increased stresses on organisms;

(g) Recognize that biodiversity is influenced by cultural, social, economic and biophysical factors. Cooperation between different specialists in the team is thus essential, as is the integration of findings which have a bearing on biodiversity. This guideline may be challenging to apply in EIAs of activities affecting marine and coastal biodiversity because of limited knowledge of the cultural, economic, and social factors that influence biodiversity in these areas, and the high likelihood that different cultural, social and economic values may have to be reconciled in these EIAs. Better collaboration among competent international organizations would improve implementation of this guideline;

(h) Provide insight into cause – effect chains. Also explain why certain chains do not need to be studied. For EIAs of activities affecting marine and coastal biodiversity, in particular biodiversity of open-ocean waters and deep-sea habitats, the knowledge limitations already discussed with regard to ecosystems and their relationships become even more important when there is a requirement to track cause-effect chains in space and time. This will not be possible for some time to come for most marine ecosystems. Potential indirect and cumulative impacts need to be better assessed and understood;

(i) If possible, quantify the changes in biodiversity composition, structure and key processes, as well as ecosystem services. Explain the expected consequences of the loss of biodiversity associated with the proposal, including the costs of replacing ecosystem services if they will be adversely affected by a proposal;

(j) Indicate the legal provisions that guide decision-making. List all types of potential impacts identified during screening and scoping and described in the terms of reference and identify applicable legal provisions. Ensure that potential impacts to which no legal provision applies are taken into account during decision-making.
Annex 4. OSPAR Recommendation 2010/5 on the assessment of environmental impacts on threatened and/or declining species and habitats. OSPAR 10/23/1-E, Annex 27

**Aims:** The Recommendation seeks to advance the duty of the OSPAR Commission under Article 3(1)(b)(ii) to develop means, consistent with international law, for instituting protective, conservation, restorative or precautionary measures related to specific areas or sites or related to specific species or habitats by recommending that OSPAR Parties take into account the relevant marine species and habitats on the OSPAR List of threatened and/or declining species and habitats (OSPAR Agreement 2008-6) when preparing assessments of environmental impacts of human activities that may affect the marine environment of the OSPAR maritime area.

It is related to the European Directives 85/337/EEC and 97/11/EC on the assessment of the effects of certain public and private projects on the environment, and Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, and responds to the conclusion of the Quality Status Report 2010 that pressures from human activities on the marine environment are increasing and that there is a need better understand and address the environmental impacts of human activities, individually or cumulatively, on vulnerable marine habitats and species,

1. **Purpose and Scope:** The purpose of this Recommendation is to support the protection and conservation of species and habitats on the OSPAR List of threatened and/or declining species and habitats, through assessments of environmental impacts of human activities.

2. **Programmes and Measures**

2.1 When assessments of environmental impacts of human activities that may affect the marine environment of the OSPAR maritime area are prepared, Contracting Parties should ensure they take account of the relevant species and habitats on the OSPAR List of threatened and/or declining species and habitats (OSPAR Agreement 2008-6).

2.2 The assessment referred to in paragraph 2.1 above should consider threats identified in the Background Documents on species and habitats on the OSPAR List published on the OSPAR website and other relevant documentation.

3. **Entry into Force**

3.1 This Recommendation has effect from 24 September 2010.

4. **Implementation reports**

4.1 Contracting Parties should report by 31 December 2011 to the OSPAR Commission on their implementation of this Recommendation and subsequently thereafter as decided by the OSPAR Commission.

4.2 When reporting on implementation, the format at Appendix 1 should be used as far as possible.
Annex 5. OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6).
http://www.ospar.org/content/content.asp?menu=00180302000014_000000_000000

**PART I : SPECIES**

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>Common name</th>
<th>OSPAR Regions$^4$ where the species occurs</th>
<th>OSPAR Regions$^4$ where the species is under threat and/or in decline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INVERTEBRATES</strong></td>
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<td>Arctica islandica</td>
<td>Ocean quahog</td>
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<td>Megabalanus azoricus</td>
<td>Azorean barnacle</td>
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<td>Nucella lapillus</td>
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<td>Patella ulysiponensis aspera</td>
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<td><strong>BIRDS</strong></td>
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<td>Steller's eider</td>
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<td>Little shearwater</td>
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<td>Puffinus mauretanicus</td>
<td>Balearic shearwater</td>
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<td>Rissa tridactyla</td>
<td>Black-legged&lt;br&gt;kittiwake</td>
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<td>Sterna dougalli</td>
<td>Roseate tern</td>
<td>All where it occurs</td>
<td></td>
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<tr>
<td>Uria aalge</td>
<td>Iberian guillemot</td>
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<tr>
<td>Uria aalge – Iberian&lt;br&gt;population (synonyms: Uria aalge albionis, Uria aalge ibericus)</td>
<td>Guillemot de&lt;br&gt;Troll</td>
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<td>Uria lomvia</td>
<td>Thick-billed murre</td>
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<td>Allis shad</td>
<td>I, III, IV</td>
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<td>Portuguese dogfish</td>
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</tbody>
</table>

$^4$ The OSPAR Regions are:

I - **the Arctic**: the OSPAR maritime area north of latitude 62°N, but also including Iceland and the Faeroes;

II - **the Greater North Sea**: the North Sea, the English Channel, the Skagerrak and the Kattegat to the limits of the OSPAR maritime area, bounded on the north by latitude 62°N, on the west by longitude 5°W and the east coast of Great Britain, and on the south by latitude 48°N;

III - **the Celtic Seas**: the area bounded by, on the east, longitude 5°W and the west coast of Great Britain and on the west by the 200 metre isobath (depth contour) to the west of 6°W along the west coasts of Scotland and Ireland;

IV - **the Bay of Biscay/Golfe de Gascogne and Iberian coasts**: the area south of latitude 48°N, east of 11°W and north of latitude 36°N (the southern boundary of the OSPAR maritime area);

V - **the Wider Atlantic**: the remainder of the OSPAR maritime area.
<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>ESP Regions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
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<tr>
<td><em>Centrophorus squamosus</em></td>
<td>Leafscale gulper shark</td>
<td>All</td>
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<td><em>Cetorhinus maximus</em></td>
<td>Basking shark</td>
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<td>Coregonus lavaretus</td>
<td>Lake charr</td>
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<td><em>Dipturus batis</em> (synonym: <em>Raja batis</em>)</td>
<td>Common Skate</td>
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<td><em>Lamna nasus</em></td>
<td>Porbeagle</td>
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</tr>
<tr>
<td><em>Petromyzon marinus</em></td>
<td>Sea lamprey</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Raja clavata</em></td>
<td>Thornback skate</td>
<td>II, III, IV, V</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Rostroraja alba</em></td>
<td>White skate</td>
<td>II</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Salmo salar</em></td>
<td>Salmon</td>
<td>II, III, IV</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Squalus acanthias</em></td>
<td>(Northeast Atlantic) spurdog</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Squatina squatina</em></td>
<td>Angel shark</td>
<td>II, III, IV</td>
<td>All where it occurs</td>
</tr>
<tr>
<td><em>Thunnus thynnus</em></td>
<td>Bluefin tuna</td>
<td>V</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>REPTILES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caretta caretta</td>
<td>Loggerhead turtle</td>
<td>V, V</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>Dermochelys coriacea</td>
<td>Leatherback turtle</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>MAMMALS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balaena mysticetus</td>
<td>Bowhead whale</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>Balaenoptera musculus</td>
<td>Blue whale</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>Eubalaena glacialis</td>
<td>Northern right whale</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
<tr>
<td>Phocoena phocoena</td>
<td>Harbour porpoise</td>
<td>All</td>
<td>All where it occurs</td>
</tr>
</tbody>
</table>

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5 That is, the populations/stocks referred to in ICES advice as the North Sea, Eastern Channel and Skagerrak cod stock; Kattegat cod stock; Cod west of Scotland; Cod in the Irish Sea; Cod in the Celtic Sea. (The naming of the stocks was corrected by OSPAR 2014 to align with ICES cod divisions).

6 In accordance with the comments of ICES in its review, the varying states of the numerous different stocks have to be taken into account.

7 The main threat is the high rate of catch of juvenile fish of the species (SCRS Report, page 59).
# Part II - Habitats

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>OSPAR Regions where the habitat occurs</th>
<th>OSPAR Regions where such habitats are under threat and/or in decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonate mounds</td>
<td>I, V</td>
<td>V²</td>
</tr>
<tr>
<td>Coral Gardens</td>
<td>I, II, III, IV, V</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Cymodocea meadows</td>
<td>IV</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Deep-sea sponge aggregations</td>
<td>I, III, IV, V</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Intertidal <em>Mytilus edulis</em> beds on mixed and sandy sediments</td>
<td>II, III</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Intertidal mudflats</td>
<td>I, II, III, IV</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Littoral chalk communities</td>
<td>II</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Lophelia pertusa reefs</td>
<td>All</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Maerl beds</td>
<td>All</td>
<td>III</td>
</tr>
<tr>
<td><em>Modiolus modiolus</em> beds</td>
<td>All</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Oceanic ridges with hydrothermal vents/fields</td>
<td>I, V</td>
<td>V</td>
</tr>
<tr>
<td>Ostrea edulis beds</td>
<td>I, III, IV</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Sabellaria spinulosa reefs</td>
<td>All</td>
<td>II, III</td>
</tr>
<tr>
<td>Seamounts</td>
<td>I, IV, V</td>
<td>All where they occur</td>
</tr>
<tr>
<td>Sea-pen and burrowing megafaunal communities</td>
<td>I, II, III, IV</td>
<td>II, III</td>
</tr>
<tr>
<td>Zostera beds</td>
<td>I, II, III, IV</td>
<td>All where they occur</td>
</tr>
</tbody>
</table>

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⁸ To be confirmed in the light of further survey work being undertaken by Ireland
Source: OSPAR 08/24/1, Annex 6) (Reference number: 2008-1)

CODE OF CONDUCT FOR RESPONSIBLE MARINE SCIENCE

12. **Species**: avoid, in the course of scientific research, activities which could lead to long-lasting changes in regional populations or substantially reduce the number of individuals present.

13. **Habitats**: avoid, in the course of scientific research, activities which could lead to substantial physical, chemical, biological or geological changes or damage to marine habitats.

14. **Threatened and/or declining features**: When working in areas of particular ecological vulnerability, including, *inter alia*, the features listed in the OSPAR List of Threatened and/or Declining Species and Habitats utmost care should be taken not to disturb or damage the features as far as possible.

15. **Management areas / marine protected areas**: When working in areas of ecological importance and/or sensitivity, including, *inter alia*, OSPAR marine protected areas, increased care has to be taken not to disturb or damage the protected features, and that activities are in compliance with regulations for the area (e.g. special requirements for operations in sensitive areas may require additional measures such as specialised training, procedures, crew, or equipment).

16. Further, scientists are requested to respect the importance of management areas like marine protected areas, and requirements resulting from marine spatial planning (MSP) and are asked to assist in their implementation through the use of the best scientific knowledge.

17. **Notification and research planning**: Avoid activities which could disturb the experiments and observations of other scientists. This requires that scientists: a) make themselves familiar with the status of current and planned research in an area; and b) that they ensure that their own research activities and plans are known to the rest of the international research community via appropriate public domain data bases and web sites.\(^9\)

18. If research is planned in an area that contains features on the OSPAR List of Threatened and/or Declining Species and Habitats, a risk assessment should be completed before equipment that may have adverse effects is deployed and, where appropriate, a pre-assessment of the site should be conducted to determine possible impacts and suitable mitigation measures. If necessary, the operator should consider modifying equipment and/or approaches to be employed in order to reduce risks to an acceptable level. In some cases it may be necessary to develop contingency measures in order to recover lost equipment (including collaboration with other research vessel operators).

19. **Methods**: Use the most environmentally-friendly and appropriate study methods which are reasonably available.

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\(^9\) For example, EDMERP is a European database of research projects related the marine environment, the purpose of which is to match up activities across disciplines and geographic areas to avoid double work and to re-use data and research without re-sampling. http://www.sea-search.net/mrp/
a. **Sampling methodologies** should be designed to match the site-specific characteristics of the area, preferably through the use of non-intrusive tools, or at least minimally intrusive tools in sensitive/protected areas.

b. The **use of chemical tracers** should be discouraged, as well as the use of expendable devices which contain hazardous materials. Where there is no alternative to these techniques, every effort should be taken to minimise their use.

c. The **level and duration** of underwater noise should be restricted to a minimum required to achieve the desired results and acoustic frequencies should be chosen which minimise impacts on marine life. In areas where marine mammals are known or are suspected to exist, additional measures may be required including, for example, soft-starts, visual surveillance and acoustic monitoring.

20. **Transport of biota**: Ensure that transport of biota between different marine regions, which could lead to changes in the environment or the composition of marine communities, does not occur.

21. **Collections**: Avoid collections that are not essential to the conduct of the scientific research, and reduce the number of samples to the necessary minimum. Scientists should consider available existing biological and physical data and/or samples from the target site.

22. **Collaboration and cooperation**: Ensure the fullest possible use of all biological, chemical and geological samples through collaborations and cooperation within the global community of scientists. Samples which can be archived should be placed in accessible repositories for future use.

**Data-sharing**: Practise international sharing of data, samples and results in order to minimize the amount of unnecessary sampling and to further a global understanding of the marine environment.

**Function:** The Guidelines were developed by the FAO to assist States and regional fisheries management organizations and arrangements in sustainably managing deep sea fisheries and in implementing the requirements of UN General Assembly Resolution 61/105 on deep sea bottom fisheries in the high seas.

**Key concepts: vulnerable marine ecosystems and significant adverse impacts**

**Characteristics of species exploited by deep-sea fisheries**

13. Many marine living resources exploited by DSFs in the high seas have biological characteristics that create specific challenges for their sustainable utilization and exploitation. These include:
   i. maturation at relatively old ages;
   ii. slow growth;
   iii. long life expectancies;
   iv. low natural mortality rates;
   v. intermittent recruitment of successful year classes; and
   vi. spawning that may not occur every year.

As a result, many deep-sea marine living resources have low productivity and are only able to sustain very low exploitation rates. Also, when these resources are depleted, recovery is expected to be long and is not assured. The great depths at which marine living resources are caught by DSFs in the high seas pose additional scientific and technical challenges in providing scientific support for management. Together these factors mean that assessment and management have higher costs and are subject to greater uncertainty.

**Vulnerable marine ecosystems**

14. Vulnerability is related to the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the likelihood that it would recover and in what time frame. These are, in turn, related to the characteristics of the ecosystems themselves, especially biological and structural aspects. VME features may be physically or functionally fragile. The most vulnerable ecosystems are those that are both easily disturbed and very slow to recover, or may never recover.

15. The vulnerability of populations, communities and habitats must be assessed relative to specific threats. Some features, particularly those that are physically fragile or inherently rare, may be vulnerable to most forms of disturbance, but the vulnerability of some populations, communities and habitats may vary greatly depending on the type of fishing gear used or the kind of disturbance experienced.

16. The risks to a marine ecosystem are determined by its vulnerability, the probability of a threat occurring and the mitigation means applied to the threat.

**Significant adverse impacts**
17. Significant adverse impacts are those that compromise ecosystem integrity (i.e. ecosystem structure or function) in a manner that:
   i. impairs the ability of affected populations to replace themselves;
   ii. degrades the long-term natural productivity of habitats; or
   iii. causes, on more than a temporary basis, significant loss of species richness, habitat or community types. Impacts should be evaluated individually, in combination and cumulatively.

18. When determining the scale and significance of an impact, the following six factors should be considered:
   i. the intensity or severity of the impact at the specific site being affected;
   ii. the spatial extent of the impact relative to the availability of the habitat type affected;
   iii. the sensitivity/vulnerability of the ecosystem to the impact;
   iv. the ability of an ecosystem to recover from harm, and the rate of such recovery;
   v. the extent to which ecosystem functions may be altered by the impact; and
   vi. the timing and duration of the impact relative to the period in which a species needs the habitat during one or more of its life history stages.

19. Temporary impacts are those that are limited in duration and that allow the particular ecosystem to recover over an acceptable time frame. Such time frames should be decided on a case-by-case basis and should be in the order of 5-20 years, taking into account the specific features of the populations and ecosystems.

20. In determining whether an impact is temporary, both the duration and the frequency at which an impact is repeated should be considered. If the interval between the expected disturbance of a habitat is shorter than the recovery time, the impact should be considered more than temporary. In circumstances of limited information, States and RFMO/As should apply the precautionary approach in their determinations regarding the nature and duration of impacts.

**Identifying vulnerable marine ecosystems and assessing significant adverse impacts**

42. A marine ecosystem should be classified as vulnerable based on the characteristics that it possesses. The following list of characteristics should be used as criteria in the identification of VMEs.
   i. Uniqueness or rarity – an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems. These include: • habitats that contain endemic species; • habitats of rare, threatened or endangered species that occur only in discrete areas; or • nurseries or discrete feeding, breeding, or spawning areas.
   ii. Functional significance of the habitat – discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species.
   iii. Fragility – an ecosystem that is highly susceptible to degradation by anthropogenic activities.
   iv. Life-history traits of component species that make recovery difficult – ecosystems that are characterized by populations or assemblages of species with one or more of the following characteristics: • slow growth rates; • late age of maturity; • low or unpredictable recruitment; or • long-lived.
v. Structural complexity – an ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms. Examples of potentially vulnerable species groups, communities and habitats, as well as features that potentially support them are contained in the Annex.

43. These criteria should be adapted and additional criteria should be developed as experience and knowledge accumulate, or to address particular local or regional needs.

ANNEX
Examples of potentially vulnerable species groups, communities and habitats, as well as features that potentially support them

The following examples of species groups, communities, habitats and features often display characteristics consistent with possible VMEs. Merely detecting the presence of an element itself is not sufficient to identify a VME. That identification should be made on a case-by-case basis through application of relevant provisions of these Guidelines, particularly Sections 3.2 and 5.2.

Examples of species groups, communities and habitat forming species that are documented or considered sensitive and potentially vulnerable to DSFs in the high-seas, and which may contribute to forming VMEs:

(i) certain coldwater corals and hydroids, e.g. reef builders and coral forest including: stony corals (Scleractinia), alcyonaceans and gorgonians (Octocorallia), black corals (Antipatharia) and hydrocorals (Stylasteridae);
(ii) some types of sponge dominated communities;
(iii) communities composed of dense emergent fauna where large sessile protozoans (xenophyophores) and invertebrates (e.g. hydroids and bryozoans) form an important structural component of habitat; and
(iv) seep and vent communities comprised of invertebrate and microbial species found nowhere else (i.e. endemic).

Examples of topographical, hydrophysical or geological features, including fragile geological structures, that potentially support the species groups or communities, referred to above:

(i) submerged edges and slopes (e.g. corals and sponges);
(ii) summits and flanks of seamounts, guyots, banks, knolls, and hills (e.g. corals, sponges, xenophyophores);
(iii) canyons and trenches (e.g. burrowed clay outcrops, corals);
(iv) hydrothermal vents (e.g. microbial communities and endemic invertebrates); and
(v) cold seeps (e.g. mud volcanoes for microbes, hard substrates for sessile invertebrates).
Annex 8. International Seabed Authority, 2011. Advisory Opinion of the Seabed Disputes Chamber on the responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area.

ISBA/17/C/6

Summary: The legal requirements of States sponsoring mining entities under UNCLOS were further explained through a special advisory opinion of the Seabed Disputes Chamber of the International Tribunal for the Law of the Sea in 2011. The Chamber advised that all sponsoring States—developed and developing alike—were required to exercise a high degree of “due diligence” to ensure that an entity they sponsor, including natural and juridical persons, comply with UNCLOS and the regulations adopted by the Authority.

What is meant by “due diligence”: A State is obliged to adopt and enforce laws, regulations and administrative measures at all times that it is acting as a sponsor of an entity. Such measures must be at least as stringent as those adopted by the Authority and no less effective than any other relevant international rules, regulations and procedures for environmental protection.

Rules and standards must give effect to:

2) the precautionary approach based on Principle 15 of the Rio Declaration, requiring actions where scientific evidence is insufficient but “where there are plausible indications of potential risk”;
3) best environmental practices (i.e., more than just best available technology);
4) technical and financial guarantees by a contractor;
5) requirements to provide recourse for compensation; and
6) the obligation to conduct an environmental impact assessment.

Due diligence standard the same for all States: To prevent the rise of “sponsoring States of convenience” with varying regulatory requirements, the Chamber ruled that the due diligence obligation was the same for both developed and developing States.

Result: most States may find it necessary to introduce new laws, administrative procedures and resources to provide the requisite rules, regulations and procedures. Otherwise, according to the Chamber, they may be held liable for damage (including to the marine environment) caused by their failure to exercise due diligence.

Additional details

Authoritative interpretation: This Advisory Opinion rendered by consensus by special Seabed Disputes Chamber of the International Tribunal for the Law of the Sea is considered to be an authoritative interpretation of the scope of responsibilities and obligations of States sponsoring contractors in the Area.

Origin of request: The Advisory Opinion was prompted by the request of Nauru and Tonga for clarity on extent of legal liability of sponsoring states who are also developing countries. “Not only do some developing States lack the financial capacity to execute a seafloor mining project in international waters, but some also cannot afford exposure to the legal risks potentially associated with such a project.”
What does the State “obligation to take measures necessary to ensure” effective compliance entail?

- “to ensure” is the same as “an obligation to act with due diligence”: It is an obligation which entails not only the adoption of appropriate rules and measures, but also a certain level of vigilance in their enforcement and the exercise of administrative control applicable to public and private operators, such as the monitoring of activities undertaken by such operators (para 115, quoting from the Pulp Mills on the River Uruguay Case para 197).
- Due diligence is a variable concept, what is required depends on risks and level of scientific and technological knowledge. The standard “has to be more severe for the riskier activities” (para 117)

What are the direct obligations incumbent on sponsoring States (para 122)?

- the obligation to assist the Authority in the exercise of control over activities in the Area;
- the obligation to apply a precautionary approach;
- the obligation to apply best environmental practices;
- the obligation to take measures to ensure the provision of guarantees in the event of an emergency order by the Authority for protection of the marine environment;
- the obligation to ensure the availability of recourse for compensation in respect of damage caused by pollution; and
- the obligation to conduct environmental impact assessments.

The provisions of the Nodule Regulations transform the non-binding statement of the precautionary approach in the Rio Declaration into a binding obligation. The implementation of the precautionary approach as defined in these Regulations is one of the obligations of sponsoring States (para 127).

The precautionary approach is also an integral part of the general obligation of due diligence of sponsoring States, which is applicable even outside the scope of the Regulations.

By stating that the precautionary approach shall be applied by States “according to their capabilities“, the first sentence of Principle 15 introduces the possibility of differences in application of the precautionary approach in light of the different capabilities of each State (but note: capabilities will be defined based on what is available to it). (para 129)

The due diligence obligation of the sponsoring States requires them to take all appropriate measures to prevent damage that might result from the activities of contractors that they sponsor. This obligation applies in situations where scientific evidence concerning the scope and potential negative impact of the activity in question is insufficient but where there are “plausible indications of potential risks.” (para 131)

Best environmental practices: obligation to apply best environmental practices applies as part of the general obligation of due diligence—this is a standard higher than “best technology available to the contractor” (Para 136)

Environmental impact assessments: The sponsoring State is obliged not only to cooperate with the Authority in the establishment and implementation of impact assessments, but also to use
appropriate means to ensure that the contractor complies with its obligation to conduct an environmental impact assessment.

**Equality of treatment:** No difference in level of responsibilities required for sponsoring States, whether developing or developed.

**Equality of treatment** between developing and developed sponsoring States is consistent with the need to prevent commercial enterprises based in developed States from setting up companies in developing States, acquiring their nationality and obtaining their sponsorship in the hope of being subjected to less burdensome regulations and controls. “The spread of sponsoring States ‘of convenience’ would jeopardize uniform application of the highest standards of protection of the marine environment, the safe development of activities in the Area and protection of the common heritage of mankind” (para. 159).

Though Rio Principle 15 on the Precautionary Approach recognizes that States shall apply precaution “according to their capabilities”, these capabilities may depend on the level of scientific knowledge and technical capacity available to a given State in the relevant scientific and technical fields.

All States have equal obligation to follow “best environmental practices”

Since the sponsoring State is responsible for ensuring that the contractor acts in accordance with the terms of the contract and with its obligations under the Convention, that State’s laws, regulations and administrative measures should be in force at all times that a contract with the Authority is in force. The existence of such laws, regulations and administrative measures is a necessary requirement for compliance with the obligation of due diligence of the sponsoring State and for its exemption from liability. (para 219)

The measures by sponsoring State must take the form of rules, regulations and administrative provisions. Contractual arrangements not enough. (para 223)

**Duty to act in good faith, so as not to prejudice interests of mankind as a whole:** “In the sphere of the obligation to assist the Authority acting on behalf of mankind as a whole, while deciding what measures are reasonably appropriate, the sponsoring State must take into account, objectively, the relevant options in a manner that is reasonable, relevant and conducive to the benefit of mankind as a whole. It must act in good faith, especially when its action is likely to affect prejudicially the interests of mankind as a whole.” (Para 230)

**As regards the protection of the marine environment,** national laws and regulations and administrative measures of the sponsoring State cannot be less stringent than those adopted by the Authority, or less effective than international rules, regulations and procedures.
Annex 9. World Bank: Environmental Screening Project Categories

When projects are assessed for financing one criterion to be addressed is the environmental management and sensitivity of the environment to impacts.

Category A:
Likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. Impacts may affect an area broader than the sites or facilities subject to physical works. An Environmental Assessment (EA) for a Category A project examines the project’s potential negative and positive environmental impacts, compares them with those of feasible alternatives (including ‘without project’), and recommends measures needed to prevent, minimise, mitigate, or compensate for adverse impacts and improve environmental performance. For Category A projects, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA).

Category B:
Potential adverse environmental impacts on human populations or environmentally important areas — including, for example, wetlands, forests, grasslands, and other natural habitats — (that are less adverse than for Category A). Impacts are site-specific; few/none are irreversible; in most cases mitigation measures can be designed more readily than for Category A. The scope of EA for Category B projects may vary from project to project, but is narrower than that of Category A. Like Category A projects an EA examines the project’s potential negative and positive environmental impacts and recommends measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B project EAs are described in the project documentation (Project Appraisal Document and Project Information Document).

Category C:
Likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required.
Annex 10. IFC Performance Standards

PS1: requires projects to manage their environmental and social performance throughout their lifetime, through development and implementation of an Environmental and Social Management System (ESMS) that is dynamic and continuous, and involves engagement between the project, its workers and relevant stakeholders. The project proponents should identify the environmental and social risks and impacts (including cumulative impacts) of the planned activities, within the project’s area of influence which includes the directly and indirectly affected area and any associated facilities.

PS3 relates to resource efficiency and pollution prevention.

- Technically and financially feasible resource efficiency and pollution prevention principles and techniques should be considered to avoid, or minimize, adverse impacts on human health and the environment.
- The most stringent guidelines that are applicable (eg national or international) should be used to measure performance in most cases.
- The project will avoid releasing pollutants, or if not feasible minimize or control the intensity and mass flow of their release; avoid generation of hazardous and non-hazardous waste materials, and recover/re-use or dispose of waste materials in a manner safe for human health and the environment;
- For hazardous waste disposed of by third parties, the client must ensure that contractors are reputable, licensed, and using licensed disposal sites operated to acceptable standards;
- Waste transfer and tracking documentation through to the final destination should be used for hazardous waste disposed of by third parties, and kept by the project.

PS4 relates to community health, safety and security.

- Project risks and potential impacts on priority ecosystem services (regulating and provisioning services only) should be identified, and adverse impacts should be avoided or mitigation implemented.

PS6 relates to biodiversity conservation and sustainable management of living natural resources.

- Significant residual direct and indirect project related impacts on biodiversity and ecosystem services should be identified;
- Adaptive management should be adopted, in which implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project’s lifecycle.
- If a biodiversity offset is chosen to be employed, after all appropriate avoidance, minimization and restoration measures have been applied, this should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss, or preferably a net gain in biodiversity.
- Natural habitats are areas with viable species assemblages that are largely native, and / or areas where the primary ecological functions and species composition have not essentially been modified by human activity;
- No significant conversion or degradation of natural habitats should occur without demonstrating a lack or viable alternatives on modified habitat, and without consultation and mitigation (achieving no net loss, or if possible net gain);
• Critical habitats are areas with high biodiversity value, which are of significance to Critically Endangered / Endangered, endemic or restricted range species, or that support globally significant concentrations of migratory/congregatory species, or that represent highly threatened and / or unique ecosystems, or areas associated with key evolutionary processes.

• No project activities should occur within critical habitats without demonstrating: a lack of viable alternatives on modified/natural habitat; that the project does not lead to measurable adverse impacts on biodiversity values key to critical status or on supporting ecological services; that there will not be a net reduction in global/national/regional populations of CR and EN species; that a management programme integrating robust, appropriately designed and long term biodiversity monitoring has been developed; and that mitigation achieving net gain in biodiversity values key to critical status has been identified and included within a Biodiversity Action Plan.

• The project will not intentionally introduce new alien invasive species, and will implement measures to avoid accidental or unintended introductions.

• Where adverse impacts on ecosystem services are likely, priority ecosystem services will be identified, and measures implemented to avoid these.

PS7 relates to indigenous peoples (social groups with identities distinct from mainstream groups in national societies), who may be particularly vulnerable to environmental and social impacts. Where project impacts may affect communities of indigenous peoples, these should be identified and avoided where possible, and minimised, restored or compensated if they cannot be avoided. Indigenous communities should be included in the engagement process. It may also place significant emphasis on the consultation and disclosure aspects of the process.

PS8 relates to cultural heritage, and requires projects to comply with applicable national laws and internationally recognized practices for the protection, field-based study and documentation of cultural heritage. This includes siting and designing projects to avoid significant adverse impacts to cultural heritage, and the development of chance finds and (where appropriate) removal procedures (to be implemented during project construction, operation, and closure) for areas where cultural heritage is expected to be found. Cultural heritage should be covered by the project’s engagement process.
Annex 11. Levels of Stakeholder Engagement in IFC’s sustainability framework

5.1 Levels of Stakeholder Engagement in IFC’s Sustainability Framework

<table>
<thead>
<tr>
<th>Level of Risk/Impact</th>
<th>Stakeholders</th>
<th>Client Responsibilities</th>
<th>IFC Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant</td>
<td>Indigenous Peoples under these circumstances: 1) Impact on Lands/Natural Resources; 2) Resettlement of IFs; 3) Impacts on critical cultural heritage, including commercial use of cultural heritage.</td>
<td>Free, Prior and Informed Consent (FPIC). <em>Good Faith Negotiation</em> whereby client documents mutually accepted process, and evidence of agreement.*</td>
<td>Verification</td>
</tr>
<tr>
<td></td>
<td>Impacts on critical cultural heritage, including use for commercial purposes involving Non-IP Affected Communities.</td>
<td>BCS Determination</td>
<td>BCS Determination</td>
</tr>
<tr>
<td></td>
<td>1) Adversely affected Indigenous Peoples. 2) Potentially significantly adversely affected communities.</td>
<td>Informed Consultation and Participation (ICP): ICP builds upon the steps in Consultation (described below) and is a more in-depth process leading to client incorporating views of Affected Communities into decision-making and documenting process.*</td>
<td>BCS Determination</td>
</tr>
<tr>
<td>All Investment Activities</td>
<td>General Public</td>
<td>External communication: Client implements and maintains procedure to receive, register, screen and address communications from the public, document responses, and adjust management program. *</td>
<td>Verification</td>
</tr>
</tbody>
</table>

(*) It is expected that client responsibilities regarding stakeholder engagement activities are additive at each stage from bottom to top.
Summary: This Directive implements the Convention on access to information, public participation in decision-making and access to justice in environmental matters (the Aarhus Convention).

Purpose: The Directive is to ensure that environmental information is systematically available and distributed to the public. That information includes at least: international treaties, conventions and agreements and Community, national, regional and local legislation concerning the environment; environment policies, programmes and plans; reports on the state of the environment (to be published at least every 4 years); data on activities affecting the environment; environmental authorisations, agreements, environmental impact studies and risk assessments.

Recent changes: Among other important changes from previous legislation, the definition of environmental information has been widened, the deadlines for providing information have been tightened, and the authorities’ obligation to actively disseminate environmental information has been made firmer.

Requirements:

• Article 6(2) EIA Directive: “The public shall be informed, whether by public notices or by other appropriate means such as electronic media where available, of the following matters early in the environmental decision-making procedures referred to in Article 2(2) and, at the latest, as soon as information can reasonably be provided:
  (a) the request for development consent;
  (b) the fact that the project is subject to an environmental impact assessment procedure and, where relevant, the fact that Article 7 applies;
  (c) details of the competent authorities responsible for taking the decision, those from which relevant information can be obtained, those to which comments or questions can be submitted, and details of the time schedule for transmitting comments or questions;
  (d) the nature of possible decisions or, where there is one, the draft decision; (…)”

• Member States must ensure that public authorities make environmental information held by or for them available to any applicant, whether a natural or a legal person, on request and without the applicant having to state an interest.

• Member States must ensure that all information held by the public authorities relating to imminent threats to human health or the environment is immediately distributed to the public likely to be affected.

• Access to public registers is to be free of charge, although authorities may make a reasonable charge for supplying any environmental information.

• They are also required to respond to requests from the public for information within two months and will also be required to make information available in a wider range of formats.
**Grounds to refuse request:** Access to information can be refused if the request is too general, unreasonable, concerns internal or confidential information or concerns information not yet compiled. A request cannot be refused, however, if the information requested relates to emissions into the environment.

**Cross-reference:** The “access to justice in environmental matters” pillar has been addressed through a different directive. This provides the right to recourse to administrative or judicial procedures to dispute acts and omissions violating the provisions of environmental law.
http://www.partizipation.at/public_participation.html
http://www.friendsoftheirishenvironment.org/attachments/article/16383/access2.pdf
https://books.google.de/books?id=XpSdhPYZuEwC&pg=PA26&lpg=PA26&dq=2003/35/EC&source=bl&ots=t2WcCQNk4y&si
g=fzv6dGXhsGWMyl3dniwr3iP3e8&hl=en&sa=X&ei=eE8VecD4fYav3agOAP&ved=0CFIQ6AEwCTgK#v=onepage&q=2003%2F
35%2FEC&f=false

Summary: This Directive implements the second pillar of the Aarhus Convention — public participation in certain decision procedures relevant to the environment came into force on 25 June 2003. The deadline for transposing the Directive into national law was 25 June 2005.

Aim of the Directive (from Preamble):
• “Effective public participation in the taking of decisions enables the public to express, and the decision-maker to take account of, opinions and concerns which may be relevant to those decisions, thereby increasing the accountability and transparency of the decision-making process and contributing to public awareness of environmental issues and support for the decisions taken”.

Procedure: The Directive provides for “early and effective” public identification, consultation and participation - with detailed provisions to be arranged by Member States internally - within reasonable time, for all plans for projects that will impact the environment.

The “public concerned” qualifies people, legal entities or NGOs having vested interests in the project and its impact on the environment.

Requirements: The Directive sets out which types of plans and activities are required to be accompanied a public consultation process, for example certain installations that will affect certain members of the public or that will affect the environment. In order to further the effectiveness of the provisions of this Directive, Member States shall ensure that practical information is made available to the public on access to administrative and judicial review procedures. While the Directive does not use the phrases “integration” or “environment as a whole”, it embodies a holistic approach to environmental protection.

Consultation vs. Participation: Consultation is a one-off process to gather information, expertise and opinions that may or may not influence eventual decisions. Participation is a process that enables individuals and organisations to be continuously or repeatedly involved in the development of decisions that affect them. It may also involve the development of relationships among the participants that will enable consensus decision-making. A participatory process may include consultation exercises. In other words, public participation means a more intensive involvement than consultation, and a correspondingly greater sense of ownership of the eventual outcomes.

Annex II: Public participation in decision-making
1. The public shall be informed (by public notices or other appropriate means such as electronic media where available) of the following matters early in the procedure for the taking of a decision or, at the latest, as soon as the information can reasonably be provided:
   (a)...
(b) where applicable, the fact that a decision is subject to a national or transboundary environmental impact assessment or to consultations between Member States in accordance with Article 17.

Summary: The Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. It is described as a novel, innovative environmental agreement that focuses on procedural and governance aspects of environmental protection (government accountability, transparency and responsiveness). For example, it:

- Links environmental rights and human rights
- Acknowledges that we owe an obligation to future generations
- Establishes that sustainable development can be achieved only through the involvement of all stakeholders
- Links government accountability and environmental protection

Key requirements: The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective. The Convention provides for:

- **the right to receive environmental information that** is held by public authorities ("access to environmental information"). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession;

- **the right to participate in environmental decision-making**. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for projects affecting the environment, or plans and programmes relating to the environment. These comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it.

- **the right to review procedures** to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("access to justice").

Membership: ECE Parties. The Convention is open to accession by non-ECE countries, subject to approval of the Meeting of the Parties.

Key Definitions:
3. “Environmental information” means any information in written, visual, aural, electronic or any other material form on:
   (a) The state of elements of the environment, such as air and atmosphere, water, soil, land, landscape and natural sites, biological diversity and its components, including genetically modified organisms, and the interaction among these elements;
   (b) Factors, such as substances, energy, noise and radiation, and activities or measures, including administrative measures, environmental agreements, policies, legislation, plans and programmes, affecting or likely to affect the elements of the environment within the
scope of subparagraph (a) above, and cost-benefit and other economic analyses and assumptions used in environmental decision-making;
(c) The state of human health and safety, conditions of human life, cultural sites and built structures, inasmuch as they are or may be affected by the state of the elements of the environment or, through these elements, by the factors, activities or measures referred to in subparagraph (b) above;

Key Provisions:

Article 3.7. Each Party shall promote the application of the principles of this Convention in international environmental decision-making processes and within the framework of international organizations in matters relating to the environment (the Almaty Guidelines elaborate on this requirement further).

Article 5: COLLECTION AND DISSEMINATION OF ENVIRONMENTAL INFORMATION
6. Each Party shall encourage operators whose activities have a significant impact on the environment to inform the public regularly of the environmental impact of their activities and products, where appropriate within the framework of voluntary eco-labelling or eco-auditing schemes or by other means.

Article 6: PUBLIC PARTICIPATION IN DECISIONS ON SPECIFIC ACTIVITIES
1. Each Party:
   (a) Shall apply the provisions of this article with respect to decisions on whether to permit proposed activities listed in annex I;
   (b) Shall, in accordance with its national law, also apply the provisions of this article to decisions on proposed activities not listed in annex I which may have a significant effect on the environment. To this end, Parties shall determine whether such a proposed activity is subject to these provisions; and...

Article 9: ACCESS TO JUSTICE
3. In addition and without prejudice to the review procedures referred to in paragraphs 1 and 2 above, each Party shall ensure that, where they meet the criteria, if any, laid down in its national law, members of the public have access to administrative or judicial procedures to challenge acts and omissions by private persons and public authorities which contravene provisions of its national law relating to the environment.

Non-compliance mechanism: The Meeting of the Parties to the Convention is required to establish, on a consensus basis, optional arrangements for reviewing compliance with the provisions of the Convention. Such arrangements are to allow for 'appropriate public involvement'.

Rio+20 reaffirmation: The basic principles in the Aarhus Convention were reaffirmed by all Heads of State and governments, and made more broadly applicable through the Rio+20 Outcome Document: the Future we Want, from the UN Conference on Sustainable Development, Rio De Janeiro, Brazil. June 2012

• 43. We underscore that broad public participation and access to information and judicial and administrative proceedings are essential to the promotion of sustainable development.
• ...we agree to work more closely with Major Groups and other stakeholders and encourage their active participation, as appropriate, in processes that contribute to decision making,
planning and implementation of policies and programmes for sustainable development at all levels.

- 76. ... We therefore resolve to strengthen the institutional framework for sustainable development, which will, *inter alia*: ...(h) enhance the participation and effective engagement of civil society and other relevant stakeholders in the relevant international fora and in this regard promote transparency and broad public participation and partnerships to implement sustainable development;

- 172. We recognize the need for transparency and accountability in fisheries management by regional fisheries management organizations (RFMOs). ...

**Almaty Guidelines Annex**

34. Subject to the more specific guidance contained in other relevant paragraphs, the participation of the public concerned should include, at meetings in international forums, the entitlement to have access to all documents relevant to the decision-making process produced for the meetings, to circulate written statements and to speak at meetings, without prejudice to the ability of international forums to prioritize their business and apply their rules of procedure.
Annex 15. Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area
(ISBA/6/A/18, 13 July 2000, as amended by ISBA/19/A/9 and ISBA/19/A/12, 25 July 2013, and ISBA/20/A/9, 24 July 2014)

Key definitions:
(a) “Exploitation” means the recovery for commercial purposes of polymetallic nodules in the Area and the extraction of minerals therefrom, including the construction and operation of mining, processing and transportation systems, for the production and marketing of metals;
(b) “Exploration” means the searching for deposits of polymetallic nodules in the Area with exclusive rights, the analysis of such deposits, the use and testing of recovery systems and equipment, processing facilities and transportation systems and the carrying out of studies of the environmental, technical, economic, commercial and other appropriate factors that must be taken into account in exploitation;
(c) “Marine environment” includes the physical, chemical, geological and biological components, conditions and factors which interact and determine the productivity, state, condition and quality of the marine ecosystem, the waters of the seas and oceans and the airspace above those waters, as well as the seabed and ocean floor and subsoil thereof;
(f) “Serious harm to the marine environment” means any effect from activities in the Area on the marine environment which represents a significant adverse change in the marine environment determined according to the rules, regulations and procedures adopted by the Authority on the basis of internationally recognized standards and practices.

Key applicable principles: precautionary approach, best environmental practices.

Standards during prospecting: minimize or eliminate adverse environmental impacts; prevent conflicts or interference with marine scientific research activities (Reg 5); prospecting is not to be undertaken if “substantial evidence indicates the risk of serious harm” to the marine environment” (Reg.2(3)).

Contractual undertakings (Reg 14):
(a) Accept as enforceable and comply with the applicable obligations created by the provisions of the Convention and the rules, regulations and procedures of the Authority, the decisions of the organs of the Authority and the terms of its contracts with the Authority;
(b) Accept control by the Authority of activities in the Area, as authorized by the Convention;

Data and information to be submitted for approval of the plan of work for exploration includes:
• Description of exploration programme, including studies in respect of environmental, technical economic and other appropriate factors
• Description of the programme for oceanographic and environmental baseline studies to enable an assessment of the potential environmental impact, including but not restricted to the impact on biodiversity
• A preliminary assessment of the possible impact
• A description of proposed measures for the “prevention, reduction and control of pollution and other hazards, as well as possible impacts, to the marine environment

Standards the LTC will impose during review of a proposed programme of work for exploration:
• Will the proposed plan of work provide for effective protection and preservation of human health and safety?
• Will it provide for effective protection of the marine environment, including but not restricted to, the impact on biodiversity?
• Will it prevent interference with recognized sea lanes or areas of intense fishing activity? (Reg 21 on Consideration by the LTC)

**Standard for when the LTC shall not recommend approval of a plan of work** includes

If part or all of the area is included in an area that has been “disapproved for exploitation by the Council in cases where substantial evidence indicates the risk of serious harm to the marine environment” (Reg 21.6)

**Standards for liability:** The contractor shall continue to have responsibility for any damage arising out of “wrongful acts” in the conduct of its operations, in particular damage to the marine environment, after the completion of the exploration phase. (Reg 30 on Responsibility and Liability)

**Requirements for Protection and Preservation of the Marine Environment** (Reg 31) include:

• The obligation for the Authority to establish and keep under periodic review environmental rules, regulations and procedures to “ensure effective protection for the marine environment from harmful effects which may arise from activities in the Area”

• The obligation of the Authority and sponsoring States to apply a “precautionary approach, as reflected in principle 15 of the Rio Declaration, and best environmental practices, so as to ensure effective protection for the marine environment from harmful effects which may arise from activities in the Area”

• The expectation that the LTC will develop and implement procedures for determining whether proposed exploration activities would have “serious harmful effects on vulnerable marine ecosystems” and ensure that “if it is determined that certain proposed activities would have serious harmful effects on vulnerable marine ecosystems” those activities are managed to prevent such effects or not authorized to proceed.

• The need for each contractor to take “necessary measures to prevent, reduce and control pollution and other hazards to the marine environment arising from its activities in the Area as far as reasonably possible, applying a precautionary approach and best environmental practices.”

• The need to cooperate with the Authority in the establishment and implementation of programmes for monitoring and evaluating the impacts of deep seabed mining on the marine environment.

• The need to include proposals, when required by Council, for areas to be set aside and used exclusively as impact reference zones or preservation reference zones
  
  o **Impact reference zones** means areas to be used for assessing the effect of activities in the Area on the marine environment and which are representative of the environmental characteristics of the Area.
  
  o **Preservation reference zones** means areas in which no mining shall occur to ensure representative and stable biota of the seabed in order to assess any changes in the biodiversity of the marine environment.

**Requirements for environmental baselines and monitoring** (Reg. 32)
• To gather environmental baseline data and to establish environmental baselines, taking into account any recommendations issues by the LTC, against which to assess the likely effects of its programme of activities
• A program to monitor and report on such effects
• To cooperate with the Authority and sponsoring State or States in the establishment and implementation of such monitoring programme.
• To report annually in writing to the Secretary General on the implementation and results of monitoring program, and to submit data and information based on recommendations pursuant to regulation 39 (on powers of LTC to issue recommendations for guidance of contractors)

**Emergency orders (Reg 33)**
• Contractor to promptly report any incident arising from activities which have caused, are causing or pose a threat of “serious harm” to the marine environment
• The Secretary General has authority to take immediate measures as are practical and reasonable in the circumstances to “prevent, contain and minimize serious harm or the threat of serious harm to the marine environment”. Measures to last no longer than 90 days.
• The Council may issue emergency orders which may include orders for the suspension or adjustment of operations, as may be reasonably necessary to prevent, contain and minimize serious harm or threat of serious harm.
• The Contractor is to provide the Council with a guarantee of its financial and technical capability to comply promptly with emergency orders or to assure that the Council can take such emergency measures.

**Confidentiality of data and information (Reg 36)**
Data and information that is necessary for the formulation by the Authority of rules, regulations and procedures concerning protection and preservation of the marine environment and safety, other than proprietary equipment design data, shall not be deemed confidential.

**Standards clauses for exploration contracts (Annex IV)**
The standard clauses reflect the regulations above, which the Contractor undertakes to fulfil
Undertakings include 13.3 The Contractor shall actively carry out the programme of activities:
(a) With due diligence, efficiency and economy;
(b) With due regard to the impact of its activities on the marine environment; and
(c) With reasonable regard for other activities in the marine environment

**Inspection (Section 14)**
Contractor to permit Authority to send inspectors on board vessels and installations to
• Monitor Contractor’s compliance
• Monitor effects of such activities on the marine environment

**Safety, labour and health standards (Section 15)**
Contractor to comply with generally accepted international rules and standards for safety of life at sea and the prevention of collisions and any rules established by the Authority
Contractor to observe and comply with labour and health standards established by the Authority, which are to take into account International Labour Organization conventions and recommendations.

**Suspension and termination of contract and penalties**

Council may suspend or terminate contract if

- Contractor acts in way to result in “serious persistent and wilful violations” of the fundamental terms of the contract, ISA rules, regulations and procedures.
- Contractor has failed to comply with final binding decision
- Contractor becomes insolvent or commits an act of bankruptcy, etc.

Council and Contractor may suspend or terminate contract, if force majeure prevents contractor from performing obligations under this contract for longer than two years.

Owing to the increased interest by companies and developed States investments in deep-sea mineral resources within the EEZs of individual Island States in the SW Pacific Ocean, a regional approach to regulating deep-sea mining was initiated by the development of a joint Regional Legislative and Regulatory Framework (RLRF). The project was launched in 2011, and referred to as the SPC-EU EDF10 Deep Sea Minerals Project (or ‘the DSM Project’). It was funded by the European Union (EU) and implemented by the Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific Community (SPC). An objective of the DSM Project was to assist with the formulation of comprehensive national policies, legal frameworks and institutional capacity for P-ACP States to regulate and monitor DSM activities. A comprehensive report was produced including details of setting obligations for national laws within the wider international context, administrative arrangements and environmental management.

States are required to take all appropriate steps to ensure that DSM exploration and exploitation activities under their jurisdiction or control are appropriately managed, in accordance with international standards, including the precautionary approach. In particular, States are required to respect the regime established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS), including a duty to protect and preserve the marine environment. This requires the adoption of national laws, regulations and administrative measures dealing with a range of issues that may arise from DSM exploration and development activity. A comprehensive national DSM management regime, established by legislation, will assist P-ACP States to minimise harm to the marine environment; reputational risk; and legal uncertainty regarding the regulatory processes, which may affect investment by industry in that State’s jurisdiction. The introduction of formalised national DSM law, policy and procedures is likely to encourage and to facilitate investment.

The RLRF aimed to:

• Promote a integrated approach to DSM regulation across the region
• Provide P-ACP States with a workable guide to implementation of national policies and legislation concerning DSM activities that is consistent with international obligations, rules and standards.
• Assist P-ACP States to ensure that activities with national jurisdiction or control are consistent with the precautionary approach; are conducted with a view to minimising and mitigating the risk of environmental harm; and take into account other sea users.
• Balance regulatory requirements with sufficient incentives and security of tenure to promote investment and private sector participation in developing national marine minerals industries.
• Recommend an approach that is both efficient and cost effective to P-ACP States and to users, and proportional to the risks involved.

Chapter 18 ENVIRONMENTAL MANAGEMENT

Environmental Impact Assessment requirements:
• Prior EIA is a requirement under international law, and the means by which to implement the precautionary approach
• National legislation must therefore incorporate provision that before any DSM activities likely to have significant effect on the environment are permitted, a comprehensive report meeting set standards and assessment that effect must be provided
• Independent assessment and review.
• As on land, EIA should be prepared by a preselected and approved pool of expert individuals and companies
• If project approved, an Environmental Management Plan must be put into place
• Comprehensive review: EIA should assess impact of DSM activities and any associated activities, and cover social, cultural and health impacts

**Ecosystem services approach** is recommended. This recognises that ecosystems provide a wider variety of services than just providing resources (fish, oil, minerals), such as regulating services (waste detoxification, nutrient regeneration, carbon sequestration), production services (oxygen), future options (biogenetics, biotechnology) and cultural services (aesthetic and existence values). Attempts should be made to value and balance these services with a longer-term perspective, before taking decisions that may affect or alter those ecosystems (See the Economics of Ecosystems and Biodiversity Project Synthesis Report for more information, accessible at: http://www.teebweb.org/EEBSynthesisReport/tabid/29410/Default.aspx)

- Existing national EIA legislation may need to be amended to ensure the DSM activities and its likely impacts are appropriately covered.

**Effects based approach preferred over an activity specific approach**

- avoids generalisation about the types of activities that may be undertaken;
- accommodates the possibility that some deep seabed scientific research and/or exploration activity may not have significant environmental impacts; and
- takes into account that the ability to mitigate adverse effects/impacts of certain activities will improve over time.

One international example of this is in the Madrid Protocol on Environmental Protection to the Antarctic Treaty, Article 8 and Annex 1, which, following initial environmental evaluation, allows activities that will have a less than a minor or transitory impact to proceed; allows activities that will have a minor or transitory impact to proceed with monitoring measures in place; and requires comprehensive EIA processes for activities that are evaluated to be likely to have more than a minor or transitory impact.

**Suggested definitions:**
‘impact’ may mean: ‘the direct or indirect effect of any aspect of a project from design through to completion on human beings, fauna (including microfauna), flora (including microflora), biological diversity, soil, water, air, seabed, climate, the landscape, material assets, community structures, living standards, cultural heritage, or the interaction between any of these elements’. Risk to rare, endemic and endangered species, both those known (marine mammals, turtles, reptiles, sea birds); and those as yet unknown to science (insofar as possible) should also be factored in. Where there is doubt or uncertainty, a cautious approach should be adopted.

**Application of the precautionary approach:**
There are no established best practices for DSM work yet. International law requires the precautionary approach to be applied by States engaging with DSM activities, as there is a very low level of information held currently about the deep seabed environment, and the new technologies that may be implemented for DSM activities and its effects on that environment. In relation to the Area, the ISA’s Mining Code provides that “In order to ensure effective protection for the marine environment from harmful effects which may arise from activities in the Area, the Authority and sponsoring States shall apply a precautionary approach, as reflected in principle 15 of the Rio Declaration, and best environmental practices.”

Another formulation is: positive action to protect the environment may be required before scientific proof of harm has been provided. It can be seen then that there are two factors necessary to trigger the precautionary approach: (1) potential for harm; and (2) uncertainty about causality or magnitude of impacts.

Adopting the precautionary approach enables decision-makers to justify their decision-making on the information that is available but where there is an absence of complete scientific evidence upon which to base that decision.

Precaution may be defined as caution in advance; caution practised in the context of uncertainty; or informed prudence. Precaution introduces a shift from a culture of paying compensation for damage caused, to a decision-making framework that rather avoids the occurrence of irreversible damage.

The precautionary approach does not necessarily prevent activities with unknown effects from proceeding, but rather it requires that if they proceed, they only do so with caution; and cognisant of unknown potential impacts, with appropriate checks and risk-minimising controls in place. Precaution includes seeking out and evaluating alternatives to the proposed action. Ongoing monitoring and research is also an essential component of the precautionary approach, with a view eventually to moving into more scientifically-certain risk management mechanisms.

Paragraph 18.19. The precautionary approach requires an assessment of possible harm that is considered unacceptable, and the implementation of interventions proportionate (with specific regard to cost) to the desired level of protection and the magnitude of that possible harm. Science can estimate a risk level within a certain range of error but cannot tell us what level of risk is socially acceptable. Decisions made by applying the precautionary approach therefore cannot appeal solely to scientific or technical information for justification but must also align with social norms and values about what harm is considered acceptable.

A public participatory approach to decision-making about DSM (as detailed in section 16 – and in Principle 10 of the Rio Declaration) is recommended. Social debate will be necessary to assist Government determine the relevant social values that underpin the precautionary approach, and to determine what costs are proportionate to the benefits expected.

Paragraph 18.20. While the Rio Declaration’s statement of the precautionary approach uses the term “serious or irreversible damage”, the (binding) LOSC (and the ISA’s Mining Code) employ the term “serious harm to the marine environment” in some contexts; and elsewhere the LOSC uses:
“serious and harmful” (e.g. Article 206), or “major harm”; and otherwise the terms “harm” or “harmful” (e.g. Article 1(4) or 145).

It is recommended that national legislation select and use consistently one of these terms from the legally binding instruments. Also, to provide a definition of that term, which is likely to require that such thresholds will be informed by scientific evidence – and may include considerations such as: provision of ecological space and margins for error; recognition of the well-being and interests of non-human entities; a shift in the burden of proof onto those who propose change; concern for inter-generational impact on future generations\(^{10}\), and recognition of the need to address ecological debts\(^{11}\).

**Paragraph 18.21** Precaution shifts the burden of proof as to the effects of the DSM activity to those who wish to carry out the activity (and who are also best-informed about it): the DSM operators. The legislation therefore should apply the precautionary approach by requiring decision-makers to take into account the best available information; to identify any uncertainty or insufficiency in the information available; and to exercise caution when the information is uncertain or insufficient (remembering that the absence of information or certainty does not necessarily imply the absence of knowledge).

- Where there is a possibility of an adverse effect, the provision of evidence that the nature or extent of this will be acceptable should rest with the DSM operator (i.e. the company carrying out the activity), who should demonstrate safety to human health and ecosystems; take financial responsibility for precautionary behaviour; undertake continuing monitoring of activities to remove the remaining uncertainties; and distribute findings.
- The decision that it is acceptable to proceed on the basis of that evidence should rest with the State (through the Regulatory Authority), who also will bear the responsibility of verification, normally achieved through peer review of EIA and careful independent monitoring of information supplied by the operator during the currency of the mining activity. Measures should be imposed to avoid, remedy or mitigate potential adverse impacts/effects.

**Paragraph 18.22. Adaptive management:** which could be described as ‘learning by doing’ – is appropriate where there is uncertainty and so is a principle that P-ACP States can follow in their pursuit of applying the precautionary approach.

- An adaptive management approach allows activities to proceed, provided they are carefully monitored and adjusted as information improves.
- Where no established practice exists, an adaptive management approach allows the DSM operator to fill the vacuum with a novel methodology. Adaptive management is implemented through ongoing monitoring and assessment of the operator’s activities, and

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\(^{10}\) 29 Inter-generational equity raises the issue of the allocation in time of natural resources – that is the principle that resources should be preserved today that will have a higher value later.

\(^{11}\) 30 An interesting formulation, which takes into account both impact and probability, can be extrapolated from the definitions section of the International Law Commission’s 2001 Articles on the Prevention of Transboundary Harm from Hazardous Activities, as follows: “‘risk of causing significant harm’ includes risks taking the form of a high probability of causing significant harm and a low probability of causing disastrous harm”.

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by amending or improving the plan of work (including methods of mitigation) in cases where new information requires changes in approach.

- An adaptive management approach should also feed into policy and law development, as the regulatory framework for DSM is likely to require ongoing amendment as new scientific knowledge is obtained, and practical experience developed.

**Paragraph 18.23.** Other examples of how the precautionary approach might be incorporated into DSM decision-making include the following:

- Comprehensive baseline research requirements in the exploration/mining licence, e.g., on the rate of encounter of new species per sample collected, or on genetic studies of species at the proposed mining sites.
- Regular reporting of data on environmental impacts (e.g., levels of emissions like noise, light, sediment plumes, and invasive species), and pre-emptive action (e.g. use of best available technology) to avert serious harm to the marine environment.
- Creation of marine protected areas in proximity to the mining footprint (see Footnote 32).
- A requirement to introduce aspects into the DSM mining methods which encourages regeneration of biota.
- An incremental approach to a DSM activity where impacts are uncertain, e.g., staged work programmes, that allow activities to be scaled up or down or cancelled, depending on observed results, or permitting trial mining (or validation sampling) on a small scale, rather than immediately authorising commercial-scale activity.

**Paragraph 18.24.** Best environmental practice: It is also an international law requirement\(^\text{12}\) of States involved with DSM activities to ensure the employment of ‘best environmental practice’, which can be summarised as “the application of the most appropriate combination of environmental control measures and strategies” (adopting wording used in the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic).

It generally refers to widely accepted norms or customs of environmental and risk management. The concept originally focussed upon technical and physical aspects (also known as ‘best available technology’) but has since evolved to take into account a wider remit of concerns for social, community and gender issues.

**Paragraph 18.25.** National legislation does not have to reflect the specifics of best environmental practice as long as the principle of best environmental practice is reflected as a statutory requirement. This enables best environmental practice to evolve over time and to adapt to specific scenarios.

A proportionality element may also be included, such that the DSM operator is required in all activities to employ best environmental practices, including the best available technologies, for the protection of the marine environment and for the prevention, reduction and control of pollution and other hazards to the marine environment arising from its activities, except where the State

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\(^{12}\) This requirement is provided in relation to the Area by the ISA Mining Code and the ITLOS Advisory Opinion; and can be seen to apply equally to national jurisdiction through Article 208 of the LOSC, which requires Coastal States to adopt laws and regulations to prevent, reduce and control pollution of the marine environment arising from seabed activities within national jurisdiction, which are no less effective than international rules, standards and recommended practices and procedures, such as the Mining C
Regulating Authority determines that the incremental benefits are clearly insufficient to justify the incremental costs of using such methods or measures.

**Paragraph 18.26.** It should be established by the legislation, regulations and licence documentation that, not only is the DSM operator’s obligation to satisfy the requirement of best environmental practices, but also to provide the State (via its Regulating Authority) with reporting information to confirm that best practices are being employed. (Also, to update the Regulating Authority as they adopt better technology or methodologies, during the term of the licence. What constitutes ‘best environmental practice’ is likely to evolve throughout the duration of the operation, and the duty should be a continuing one). The Regulating Authority’s obligation will be to verify (either in-house or through independent peer review) that the information supplied by the DSM operator confirms that it is adhering to best environmental practices.

**Paragraph 18.27.** Best environmental practice will invariably be determined by the specific DSM activities involved and will be proportionate to their risk and scale.

- Best environmental practice should be incorporated into the licence terms, and the Regulating Authority’s decision-making framework.
- It also requires open reporting and verification in the field (e.g. by use of independent observers) that best environmental practice is being followed.
- Examples of best environmental practices in the context of DSM would be:
  - following the guidelines and recommendations of the ISA, as a minimum;
  - to adopt a series of control strategies to protect the marine environment – including biodiversity offsets (e.g., buffer zones or protected areas) where environmental damage is unavoidable;
  - to require from DSM operators use of the best technology for assessing the environment with minimal environmental impact (e.g., the use of autonomous underwater vehicles (AUVs) for mapping and monitoring, and remotely operated vehicles (ROVs) for sampling and imaging);
  - engaging the right expertise and capacity building through establishing partnerships and collaborations;
  - standardisation of methods and robust information management (e.g., good data archiving and access and following best practice designs for environmental surveys); and
  - submitting scientific and technical information to the CBD Secretariat’s repository on ecologically or biologically significant areas.

**Paragraph 18.28. Environmental planning:** Implementation of a comprehensive environmental plan for a State’s marine area is another potential tool to assist effective protection of the marine environment from harmful effects that may arise from DSM activities, as required by the LOSC.

- A DSM legislative regime may make provision for the preparation of strategic environmental management plans where there is an adequate degree of knowledge concerning the areas in question, or where a location-specific approach is required (e.g., where there is intensive existing use of a specific area, or the presence of specific or ecologically sensitive areas that require protection, or a preexisting marine protected area regime).
- Given the very poor knowledge of deep-sea ecosystems, applying the precautionary approach to management suggests designating areas covering a wide variety of habitats
and depths for conservation, and allowing for adaptive management as more knowledge is generated (most likely through the commercial use of resources, e.g. through activities by DSM operators).

- Plans should be drafted in a flexible and transparent manner, so as to enable improvement as more scientific, technical and environment baseline and resource assessment data are supplied by DSM operators and other relevant actors.

**Paragraph 18.29.** Historically, marine and coastal resource management have been characterised by single-sector approaches (addressing quite separately, for example: fisheries, offshore extraction of aggregates or petroleum, aquaculture, shipping, marine pollution etc.) with jurisdiction falling to different levels of government.

- In developing policies for DSM activities – a new use of marine space – integrated governance, based on the concept of ‘the ecosystem approach’, is strongly recommended.
- Activities of different sectors may mitigate or enhance the impact of others; therefore all activities need to be considered cumulatively, in a comprehensive management plan.
- Ecosystem-based management seeks to consider together all uses and industries that affect an ecosystem.
- Ecosystem-based oceans management strategies, laws and regulation for DSM mining would include provisions for:
  - collection of adequate baseline information on the marine environment where mining could potentially occur;
  - establishment of protected areas where there are vulnerable marine ecosystems, ecologically or biologically significant areas, depleted, threatened or endangered species, and representative examples of deep-sea ecosystems; and
  - adoption of a precautionary approach that, in the absence of compelling evidence to the contrary, assumes DSM mining will have adverse ecological impact.

**Paragraph 18.30.** A number of spatial management tools exist, which P-ACP States may wish to consider, or seek further advice upon. These include:

- Strategic Environmental Assessment (SEA), a systematic process for evaluating the long-term environmental consequences and other impacts of multiple actions (or plans, policies, legislation) within a certain site or ecosystem or policy area; the environmental and other impacts of plans, policies, even legislation.
- Marine Spatial Planning (MSP), which maps what activities can be undertaken where, manages conflicts between competing marine activities, and reduces environmental impact by analysing current and anticipated uses of the ocean. This may include the demarcation of reserved ‘buffer’ areas around known sites of mineral occurrences; or for areas of particular ecological or cultural sensitivity.
- Marine Protected Areas (or ‘Marine Managed Area’ or ‘Seabed Protected Area’) can be defined as any area of the coastal zone or open ocean/deep seabed, which has been accorded a level of protection for the purpose of managing the use of resources and ocean space, or protecting vulnerable or threatened habitats and species. Such reserves should be carefully selected: at locations and scales which recognise the intrinsic importance of the species, habitats and biotypes that they will encompass, and which maximise their value to protect and preserve the marine environment.
It has been suggested that States could choose to set aside a small percentage of their total revenue from DSM projects, in order to establish a trust fund for meeting the costs of properly upholding these environmental standards.
Corporate Social Responsibility is the way companies manage their businesses to make a positive impact on society through economic, environmental and social actions. Historically, on land, governments have arbitrated the relationship between society, business and industry and have generally viewed CSR as compliance with the laws and regulations. Although regulation can have significant social values, companies normally view them simply as a cost of doing business and a means of avoiding litigation. Nevertheless many industries, including mining sector corporations, have recognized that compliance with laws and regulations is not sufficient and that they need to be far more environmentally, socially, economically and culturally responsible by adopting and expanding CSR obligations. Indeed, a number of companies regard CSR as a necessity for growth and differentiation as shown by a recent survey by IBM (2012) that found:

- Over two-thirds (68%) of business leaders surveyed are focusing on CSR activities to create new revenue streams.
- Over half (54%) believe that their companies’ CSR activities are already giving them an advantage over their top competitors.

The widespread expansion of the CSR concept has led to the creation of the new ‘Hybrid Social Business’ (HSB) model. The HSB model is a significant modification of the traditional business model, which only incorporated general levels of CSR. A HSB company explicitly sets the expectation that it will simultaneously pursue two objectives: a) specific positive social impacts and returns; and b) specific baseline financial returns. These aims can be seen in the specific examples for IHC Merwede and Nautilus Minerals (Annexes 1 and 2).

It is proposed that the ISA, with inputs from industry and developing nations, considers the development of a Hybrid Social Business (HSB) model for industry that explicitly sets an expectation that corporate social responsibility for operations in the Area will simultaneously pursue two objectives: a) specific positive social impacts and returns; and b) specific baseline financial returns.

The HSB model may be of particular interest to the ISA in terms of addressing the issue of ‘Lost Benefits’. These relate to the normal additional benefits accrued to developing nations when mining activities are based on land, such as improvements in transport, communications, infrastructure, education and health. It is often these benefits that are felt more by local communities, than purely monetary gain, which in the past has had little impact on sustainable development.

How might this apply to the International Seabed Authority?

There is a ‘dual challenge’ of the sustainable development of deep seabed resources including the preservation of the marine environment and poverty reduction, while meeting at the same time the required rate of return on investments by investors. In addition, and more specific to the ISA, the HSB model is directly applicable to supporting the extant ISA Endowment Fund for Collaborative

Marine Scientific Research on the International Seabed (MSR) (ISA, 2008a and b, Lodge, M., 2008). From a market perspective, an HSB company programme has significant appeal to many potential investors and shareholders who wish to invest in socially responsible corporations.

The linkage of HSB and MSR with issues directly relevant to the Area as well as with developing nations’ local, national and coastal management activities represents a win-win opportunity for the ISA, industry and developing nations.


The International Marine Mineral Society (IMMS) brings together leading players in marine mining from industry, government departments and scientific institutions. As part of its work the IMMS has published a 15-page voluntary Code to guide enterprises in their environmental responsibilities. The document recognises that different types of organisations may undertake marine mining from companies to state sponsored enterprises.

In the case of mining in ‘The Area’ the ISA encourages contractors to apply the IMMS Code for Environmental Management of Marine Mining (ISBA/17/LTC/7). The ISA notes “The Code for Environmental Management of Marine Mining consists of a statement of Environmental Principles for the marine mining industry, followed by a set of Operating Guidelines for application as appropriate at specific mining sites. These Guidelines are designed to serve industry, regulatory agencies and other stakeholders as benchmarks for development, implementation and assessment of environmental management plans and as advice on best practices at sites targeted for marine mineral research, exploration and extraction. The Principles and Guidelines set broad directions in a context of shared values rather than prescribing specific practices.

The IMMS Code refers throughout to companies/entities, which has been shortened to companies in most cases in the text below.

Companies/entities adopting the Code commit themselves:

- To observe the laws and policies and respect the aspirations of sovereign states and their regional sub-divisions, and of international law, as appropriate to underwater mineral developments.
- To apply best practical and fit-for-purpose procedures for environmental and resource protection, considering future activities and developments within the area that might be affected.
- To consider environmental implications and observe the precautionary approach, from initiating a project through all stages from exploration through development and operations, including waste disposal, to eventual closure, and post-closure monitoring.
- To consult with stakeholders and facilitate community partnerships on environmental matters throughout the project’s life cycle.
- To maintain an environmental quality review program and deliver on commitments.
- To provide transparency in their environmental activities by regular reporting of environmental planning, monitoring, assessment and other actions relating to protecting and preserving the marine environment.

The Code contains a number of ‘Operating Guidelines’ relating to responsible and sustainable development, company ethics, partnerships, environmental risk management, environmental rehabilitation, decommissioning, the collection, exchange and archiving of data, and the setting of performance targets reporting procedures and compliance reviews.

The Code promotes the integration and equal consideration of environmental, economic and social matters in planning, decision-making and management. The use of innovative technologies are
foreseen to promote environmentally responsible operations including the prevention, minimization and recycling of emissions and wastes and the minimization of noise. The aim is minimize impacts in order to maintain long-term ecosystem health, functions and services and protect cultural heritage, knowledge and values of the marine environment, including designated marine protected areas and reserves. Ultimately there is a need to consider biological resource potential and the value of living organisms as well as the mineral resource potential and value.

In order to achieve these goals the Code foresees the need for companies to develop environmentally responsible ethics by showing management commitment, implementing environmental management systems, and providing time and resources to demonstrate environmental commitment by employees, contractors and suppliers of equipment, goods and services. The importance of engaging with the wider community about the company’s environmental principles is considered a key activity, particularly in a dialogue about concerns, aspirations and values regarding the development and operation of marine mining projects, with active modifications to project plans and practices according to the consultations.

The Codes recognises the need to conduct environmental baseline studies and use them as the basis for setting up subsequent long-term environmental monitoring programmes at suitable spatial and temporal scales, and as the basis for risk management procedures. Reference is made to standards and protocols detailed in the ISA Guidelines (described elsewhere in this document) and to adopting the Precautionary Approach. In evaluating environmental risks consideration should be given to alternative project concepts, weighing positive, negative, direct, indirect, cumulative and secondary environmental consequences, as well as providing opportunities for stakeholder participation. Specific aims of engaging with the marine scientific community to advise on the recruitment, re-establishment and migration of biota are highlighted as well as assisting the study of nearby undisturbed, comparable habitats before, during, and post mining operations.

Clear management responsibilities and commitment at the highest level are seen as vital in order to integrate environmentally responsible and sustainable management practices into all operations within a company, from exploration, through design and construction to mining, minerals processing, waste disposal, mine site rehabilitation and decommissioning. In particular, a senior executive environmental manager should be appointed, preferably accountable to the company’s CEO. The environmental manager would monitor the legal and other requirements applicable to the environmental aspects of the company’s marine mining activities, products or services, as well as monitoring internal environmental performance targets and communicating these to employees and contractors. Specific recommendations are made on reviewing, improving and updating environmental policies and standards, as well as communicating these at business and scientific meetings.

Companies are also required to develop and implement closure plans to leave decommissioned sites and associated ecosystems in a safe, stable, and where possible, rehabilitated condition, according to best practices. Open and regular (at least annual) reporting of the company’s environmental performance should be undertaken, engaging with all stakeholders.

It should perhaps be noted here that few contractors to the ISA appear to meet these industry management standards, although there are a few notable exceptions.
The free exchange and accessibility of environmental information (geological and biological data), other than proprietary technical information, is encouraged with international scientific peer review. Many data have national and global heritage use and should be freely available. Non-proprietary environmental data should be excluded from confidentiality requirements. The data should be standardized according to the latest and highest standards for the relevant discipline in order to facilitate analysis and comparisons. They should be deposited in a national or international archive for long-term and accessible use. Using the data a company should promote good practices in marine environmental and biodiversity assessment and management.

Every three years or so a company should evaluate its environmental performance under the Code using a team of qualified, externally accredited environmental auditors from within, and independent of, the company.

http://ec.europa.eu/environment/eia/sea-legalcontext.htm;


Summary: The policies and programmes (P&P) covered by the Directive are subject to an environmental assessment during their preparation, and before their adoption. This includes the drawing up of an environmental report in which the likely significant effects on the environment and the reasonable alternatives are identified, and the carrying out of consultations (with the public, the environmental authorities, and with other MS in the case of transboundary impacts). The environmental report and the results of the consultations are taken into account before adoption. Once a P&P is adopted, the environmental authorities and the public are informed and relevant information is made available to them. In order to identify unforeseen adverse effects at an early stage, significant environmental effects of the P&P are to be monitored.

Objective: As called for by the Convention on Biological Diversity, the SEA is a tool to help integrate biodiversity considerations into plans and programmes likely to have significant effects:

“The objective of this Directive is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment. (Article 1)

Common Procedural requirements: The different environmental assessment systems operating within Member States are to contain a set of common procedural requirements necessary to contribute to a “high level of protection of the environment”.

Minimum standards and principles only: Sets out the broad principles of the environmental assessment system and leaves the details to the Member States, having regard to the principle of subsidiarity.

The SEA procedure can be summarized as follows:

- An environmental report is prepared in which the likely significant effects on the environment and the reasonable alternatives of the proposed plan or programme are identified.
- The public and the environmental authorities are informed and consulted on the draft plan or programme and the environmental report prepared.
- If plans and programmes are likely to have significant effects on the environment of another Member State, they must be consulted.
- Same general approach on consultation as taken by the SEA Protocol to the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context.
- The environmental report and the results of the consultations are taken into account before adoption.
- Once the plan or programme is adopted, the environmental authorities and the public are informed and relevant information is made available to them.
In order to identify unforeseen adverse effects at an early stage, significant environmental effects of the plan or programme are to be monitored.

The SEA and EIA procedures are very similar, but there are some differences:

- the SEA requires the environmental authorities to be consulted at the screening stage;
- scoping (i.e. determining the content and extent of the matters to be covered in the SEA) is obligatory under the SEA;
- the SEA requires an assessment of reasonable alternatives (under the EIA the developer chooses the alternatives to be studied);
- under the SEA Member States must monitor the significant environmental effects of the implementation of plans/programmes in order to identify unforeseen adverse effects and undertake appropriate remedial action.
- the SEA obliges Member States to ensure that environmental reports are of a sufficient quality.

Key extracts

Article 5 Environmental report: to identify, describe and evaluate the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme. The information required is referred to in Annex I.

Article 8 Decision making. The environmental report, any public opinions, and results to transboundary consultations are to be taken into account during the preparation of the plan or programme and before its adoption or submission to the legislative procedure.

Article 10 Monitoring. Member States are to monitor the significant environmental effects of the implementation of plans and programmes in order, inter alia, to identify at an early stage unforeseen adverse effects, and to be able to undertake appropriate remedial action. Existing monitoring arrangements may be used if appropriate, with a view to avoiding duplication of monitoring.

ANNEX I Information for Environmental Reports as referred to in Article 5(1)

(a) an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes;
(b) the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;
(c) the environmental characteristics of areas likely to be significantly affected;
(d) any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;
(e) the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account in its preparation;
(f) the likely significant effects (1) on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors;
(g) the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme;

(h) an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;

(i) a description of the measures envisaged concerning monitoring in accordance with Article 10;

(j) a non-technical summary of the information provided under the above headings.

ANNEX II Criteria for determining the likely significance of effects referred to in Article 3(5)

1. The characteristics of plans and programmes, having regard, in particular, to
   • the degree to which the plan or programme sets a framework for projects and other activities, either with regard to the location, nature, size and operating conditions or by allocating resources,
   • the degree to which the plan or programme influences other plans and programmes including those in a hierarchy,
   • the relevance of the plan or programme for the integration of environmental considerations in particular with a view to promoting sustainable development,
   • environmental problems relevant to the plan or programme,
   • the relevance of the plan or programme for the implementation of Community legislation on the environment (e.g. plans and programmes linked to waste-management or water protection).

2. Characteristics of the effects and of the area likely to be affected, having regard, in particular, to
   • the probability, duration, frequency and reversibility of the effects,
   • the cumulative nature of the effects,
   • the transboundary nature of the effects,
   • the risks to human health or the environment (e.g. due to accidents),
   • the magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected),
   • the value and vulnerability of the area likely to be affected due to:
     • special natural characteristics or cultural heritage,
     • exceeded environmental quality standards or limit values,
     • intensive land-use,
     • the effects on areas or landscapes which have a recognised national, Community or international protection status.

Impact: Overall, it can be concluded that the SEA Directive contributes to the systematic and structured consideration of environmental concerns in planning processes and better integration of environmental considerations upstream. In addition, by means of its requirements (environmental report, consultation and information of the authorities and public concerned etc.) it ensures better and harmonized planning procedures, and contributes to transparent and participatory decision making processes.

Introduction:
The Kyiv (SEA) Protocol supplements the Convention on Environmental Impact Assessment (EIA) in a Transboundary Context. Strategic environmental assessment (SEA) is undertaken much earlier in the decision-making process than project environmental impact assessment (EIA), and it is therefore seen as a key tool for sustainable development. The SEA Protocol is not limited to transboundary impacts from plans and programmes; it is also concerned with impacts from plans and programmes within a Contracting State. The Protocol also addresses policies and legislation, which is not the case of the EC SEA Directive.

Key principles:
Millennium Development Goal 7: Ensure environmental sustainability
Target 1: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Rio Declaration on Environment and Development (1992) Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Membership: Although negotiated under UNECE, the Protocol is open to all UN members.

Objectives: to provide for a high level of protection of the environment, including health, by:
 a) Ensuring that environmental, including health, considerations are thoroughly taken into account in the development of plans and programmes;
 b) Contributing to the consideration of environmental, including health, concerns in the preparation of policies and legislation;
 c) Establishing clear, transparent and effective procedures for strategic environmental assessment;
 d) Providing for public participation in strategic environmental assessment; and
 e) Integrating by these means environmental, including health, concerns into measures and instruments designed to further sustainable development. (art. 1)

Field of application: “industry including mining” (art. 4)

What it requires:
• The Protocol requires its Parties to evaluate the environmental consequences of their official draft plans and programmes.
• The Protocol also addresses policies and legislation, though the application of SEA to these is not mandatory.
• SEA is undertaken much earlier in the decision-making process than EIA, and it is therefore seen as a key tool for sustainable development.
• SEA allows the identification and prevention of possible environmental impact right from the start in decision-making — developing a more sustainable transport policy rather than just minimizing the environmental impact of building a road, for example — and it enables
environmental objectives to be considered on a par with socio-economic ones, bringing sustainable development closer.

Public Participation:

The Protocol provides for extensive public participation in government decision-making: The public not only has the right to know about plans and programmes, but also the right to comment, have their comments taken into account, and be told of the final decision and why it was taken.


Relevance to Climate change [http://www.unece.org/env/eia/about/climate.html]

Strategic environment assessment (SEA) can be an effective tool for climate change adaptation and mitigation, by introducing climate change considerations into development planning and ensure that plans and programmes take full account of climate issues within a clear, systematic process.

The Protocol on SEA requires the developers of plans and programmes to assess the likely effects of their plans and programmes on “the environment, including ... climate ... and the interaction among these factors” (Art. 2, para. 7, of the Protocol). The likely significant effects to be described in the environmental report should include secondary and cumulative effects. Climate change is a cumulative effect: it is caused by the build up of many actions, each of which only has a limited contribution, but which together cause serious effects.

The Protocol requires development of measures to prevent, reduce or mitigate adverse effects (item 7 of annex IV of the Protocol). Adaptation measures are unusual in that they require consideration of how climate changes are likely to impact on plans and programmes.

Annexes

ANNEX I: List of projects as referred to in article 4, paragraph 2
ANNEX II: Any other projects referred to in article 4, paragraph 2
ANNEX III Criteria for determining of the likely significant environmental, including health, effects referred to in article 5, paragraph 1

• The relevance of the plan or programme to the integration of environmental, including health, considerations in particular with a view to promoting sustainable development.
• The degree to which the plan or programme sets a framework for projects and other activities, either with regard to location, nature, size and operating conditions or by allocating resources.
• The degree to which the plan or programme influences other plans and programmes including those in a hierarchy.
• Environmental, including health, problems relevant to the plan or programme.
• The nature of the environmental, including health, effects such as probability, duration, frequency, reversibility, magnitude and extent (such as geographical area or size of population likely to be affected).
• The risks to the environment, including health.
• The transboundary nature of effects.
• The degree to which the plan or programme will affect valuable or vulnerable areas including landscapes with a recognized national or international protection status.
Annex 21. Oil and Gas Strategic Environmental Assessments

Strategic Environmental Assessments (SEA) have been undertaken for the offshore oil and gas exploration and production sector over a number of years. SEAs are conducted to meet the European Union Strategic Environmental Assessment Directive (2001/42/EC) and the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 through the assessment of the significance of impacts arising from the likely exploration and production activities and present this outcome in an Environmental Report.

The main objectives of these SEAs include the following:

- Inform the public and provide a mechanism for public consultation of a member state’s plan for offshore oil and gas exploration and development;
- Inform the member state government of the specific environmental issues associated with offshore oil and gas exploration and development;
- Provide oil and gas companies with an operational baseline and framework for understanding the sector’s impact, thus providing a basis for good environmental performance.

Following a screening exercise to identify the need for a SEA, a typical scope and approach to SEA would include:

- Overview of the methodology developed or followed, highlighting any specific approaches to assessment and management of strategic/regional issues;
- Identification of stakeholders and consultees;
- Scoping and the initial identification of environmental issues for the SEA;
- Describing the baseline from various existing data sources;
- Consultation on the environmental issues to be assessed;
- Assessment of issues in context of environmental and socio-economic features in the study area, their sensitivity to oil and gas exploration and production and the necessity for specific management measures (with the involvement of independent experts and through workshops with stakeholders); and
- Publication of a draft SEA Report for public and stakeholder comment;
- Finalisation of SEA Report to reflect feedback from the consultation process.

In addition to the formal involvement of regulatory consultees and other key bodies, consultation would typically involve press announcement on availability of documents, making hard copies available and providing access to documents via websites.
Annex 22. UK East Anglia Offshore Wind (EAOW) Zonal Environmental Appraisal (ZEA)

Round 3 offshore wind development programme in the UK. SEA conducted and identified 9 zones for offshore wind farm development. Developers were granted exclusive rights to develop wind farms within zones (one developer for each zone).

Developers able to define individual projects within each zone, with each consented separately and requiring an individual EIA.

Zonal Appraisal and Planning (ZAP) process: strategic, non-statutory approach to design and project identification, the output of which was a Zonal Development Plan that maximises generation capacity while minimising potential impacts on sensitive receptors.

ZAP combined two process:
- Zone Technical Appraisal – considers key physical characteristics of the zone, to identify key technical constraints to development.
- ZEA - considers key environmental characteristics of the zone, to identify key environmental constraints to development. ZEA was also used to assess the potential cumulative effects of development of the multiple offshore wind farms within the EAOW zone.

ZEA included consideration of implications of developing individual wind farms, in terms of their contributions to identified cumulative effects. Key constraints were identified for each individual development area.

Assessment also considered cumulative effects with other development activities within and outside the Zone.

Zonal Development Scenario provided base case for assessment – location and approximate design of individual windfarms, expected sequence of development, generic assumptions on design of components and construction and operation methods.

ZEA highlighted areas where data uncertainties needed to be addressed in project specific EIAs.
Annex 23. UK Marine Aggregate Regional Environmental Assessments (MAREA)

Regional Environmental Assessment (REA) approach was adopted by the marine aggregate extraction industry in the UK to address cumulative effects of dredging activities within key regions. Dredging companies active within these region formed associations, and each regional association commissioned a REA to be produced.

Regions encompassed both existing license areas due for renewal and application areas yet to be dredged. REA consisted of a detailed regional assessment of potential significant impacts to physical, biological and social resources and receptors that could result from full production: ie extraction within all existing license areas alongside dredging within all application areas.

Also considered the contribution of individual license areas to overall cumulative effects from dredging, and assessed cumulative effects with other industries active in areas.

Regional assessment aimed to provide information to support decisions at the individual license EIA stage and inform the scope of the individual assessments. Impacts of potential significance were highlighted for further consideration within individual EIAs (both in general and for specific license areas expected to have a large contribution to them). Impacts considered to have no potential significance were also noted.

Overview of MAREA process:
- Scoping (initial data collection, gap analysis, developing ToR for full MAREA);
- Consultation;
- Baseline data gathering (regional scale data - identification of desktop information, collation and presentation of data, design and implementation of regional scale field surveys);
- Prediction of effects of dredging (modelling and semi-quantitative description);
- Cumulative impact assessment (analysis of interaction between extent of predicted effects of dredging with extent of key regional sensitive receptors, interaction between predicted effects of dredging and likely / known effects of other regional industries and developments).

Specialist studies undertaken at a regional scale: navigational risk; changes to bathymetry; resulting changes to wave height, tidal flows and sediment transport; plume dispersion, sediment deposition and changes to sediment distribution; effects on benthic habitat, population level effects on certain key species (sand eel, herring), underwater noise.
Annex 24. The Environmental Management Plan for the Clarion Clipperton Zone (ISBA/17/LTC/7) as decided by the ISA Council (ISBA/18/C/22) as part of a regional strategic environmental assessment.

Following detailed discussions over a number of years the Legal and Technical Commission (LTC) of the International Seabed Authority (ISA) advised the ISA Council in 2011 on the introduction of a regional environmental management plan for the whole of the Clarion Clipperton Zone, an area of about 4.5 million km² lying between Hawaii and Mexico in the equatorial Eastern Pacific Ocean. The plan was adopted by the ISA Council in 2012 noting that it should be reviewed in the light of new scientific evidence in 2015.

Under the 1982 United Nations Convention on the Law of the Sea (the Convention), States parties have a general obligation to protect and preserve the marine environment. In particular, States parties must take measures to protect and preserve rare or fragile ecosystems, as well as the habitats of depleted, threatened or endangered species and other forms of marine life. The ISA is charged with taking the measures necessary to ensure effective protection of the marine environment from the harmful effects that may arise from mining activities by adopting appropriate rules, regulations and procedures. The 1994 Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 reaffirms those responsibilities recognising the need for the “Adoption of rules, regulations and procedures incorporating applicable standards for the protection and preservation of the marine environment”.

Under Annex III to the Convention, rules, regulations and procedures must be drawn up by the ISA to secure effective protection of the marine environment, from both harmful effects directly resulting from activities in the Area and from shipboard processing of minerals immediately above a mine site. The procedures must take into account the extent to which such harmful effects may directly result from drilling, dredging, coring and excavation, as well as from disposal, dumping and discharge into the marine environment of sediment, wastes or other effluents.

The seafloor in the CCZ management area lies mostly between a water depth of 4,000 and 6,000m. Within the area there are a number of seamounts, some of which may have a summit fewer than 2,000m deep. In general, though, the seafloor is characterised by a large number of flat-floored valleys, separated by irregular, often discontinuous ridges a few hundred metres high. The seafloor is covered in polymetallic nodules about 5 to 10cm in diameter distributed irregularly across the seafloor, some areas with dense patches of nodules and other areas with none. There are thought to be some 300 billion tons of nodules in the CCZ.

A detailed scientific case was made for a spatial management plan including 9 areas closed to mining based on scientific data collected in the region and on knowledge of the drivers of change in benthic communities in the CCZ. Faunal communities vary across the Clarion-Clipperton Zone, with north-to-south and east-to-west gradients in productivity, depth and other environmental variables. In order to protect the full range of habitats and biodiversity across the Zone, destructive seafloor activities must be excluded in particular areas distributed across those gradients. A workshop held in 2007 recommended that the CCZ should be separated into three east-west and three north-south strata for conservation management because of the strong productivity-driven gradients in ecosystem
The goals of the CCZ EMP Environmental Management Plan are to:

- “Vulnerable marine ecosystems” as defined by the FAO criteria for deep-sea bottom fishing in the high seas
- Areas representative of the full range of ecosystems, habitats, communities and species of different biogeographic regions
- Areas of sufficient size to protect and ensure the ecological viability and integrity of the features for which they were selected

The APEI network also took into account existing contract and reserved areas allocated to member states and the ISA. The placement of the APEIs avoided overlap with areas licensed to contractors, as well as reserved areas.

The APEI plan allows for the modification of the location, size and number of the areas based on improved scientific information about the location of mining activity, measurement of actual impacts from mining operations, and more biological data, taking into account the Precautionary Approach which allows for flexibility and adaptive environmental management. The CCZ EMP adopts a holistic approach to the environmental management of the CCZ in its entirety, including, where appropriate, consideration of cumulative impacts, incorporating environmental risk assessments of new and developing technologies, while giving due consideration to relevant global initiatives and new legislation.

The APEIs cover an area of about 1.5 million km², or about one third of the area of the CCZ. This adopts generally accepted and widely applied principles for the design of marine protected area networks which advise the protection of 30 to 50 % of the total management area.

The Convention on Biological Diversity (CBD) and Food and Agriculture Organization of the United Nations (FAO) criteria for identifying and managing habitats and faunal communities vulnerable to human activities were not fully developed at the time of designing the initial APEI network, but the CCZ EMP design covered the key elements currently including the protection of:

- “Vulnerable marine ecosystems” as defined by the FAO criteria for deep-sea bottom fishing in the high seas
- Areas representative of the full range of ecosystems, habitats, communities and species of different biogeographic regions
- Areas of sufficient size to protect and ensure the ecological viability and integrity of the features for which they were selected

The APEI network also took into account existing contract and reserved areas allocated to member states and the ISA. The placement of the APEIs avoided overlap with areas licensed to contractors, as well as reserved areas.

The APEI plan allows for the modification of the location, size and number of the areas based on improved scientific information about the location of mining activity, measurement of actual impacts from mining operations, and more biological data, taking into account the Precautionary Approach which allows for flexibility and adaptive environmental management. The CCZ EMP adopts a holistic approach to the environmental management of the CCZ in its entirety, including, where appropriate, consideration of cumulative impacts, incorporating environmental risk assessments of new and developing technologies, while giving due consideration to relevant global initiatives and new legislation.

The goals of the CCZ EMP Environmental Management Plan are to:
• Facilitate exploitation of seabed mineral resources in an environmentally responsible manner, consistent with the legal framework and environmental guidelines of the ISA for managing deep-sea nodule mining and protecting the deep-sea environment.
• Contribute to the achievement of the management goals and targets set forth in the Plan of Implementation of the World Summit on Sustainable Development including halting the loss of biodiversity, establishing ecosystem approaches to management and developing marine protected areas, in accordance with international law and based on the best scientific information available, including representative networks by 2012.
• Maintain regional biodiversity, ecosystem structure and ecosystem function across the CCZ.
• Manage the CCZ consistent with the principles of integrated ecosystem-based management.
• Enable the preservation of representative and unique marine ecosystems.
• Capitalize upon the available knowledge and environmental data specific to the CCZ, including oceanographic and environmental baseline studies.
• Monitor the environment during and after testing of collecting systems and equipment, in accordance with the rules, regulations and procedures of the ISA.
• Facilitate cooperative research and better understanding condition within the CCZ to inform the adoption of future rules, regulations and procedures, incorporating applicable standards for the protection and preservation of the marine environment.
• Include the participation of developing countries and multilateral exchange of views on environmental management issues.
• Avoid overlap between the contractor areas, reserved areas and APEIs.

The document then lists the strategic aims, operational objectives and management targets of the plan described in more detail above. Of note, however, is the requirement that for areas licensed by the ISA contractors are required to apply the principles of ISO 14001 to the development of their site-specific environmental management plans. Such environmental management plans will be submitted with the contractor’s proposed mining plan prior to operations. In creating their environmental management plans, contractors are also encouraged to apply the Code for Environmental Management of Marine Mining adopted by the International Marine Minerals Society (IMMS) described above.

The CCZ EMP also requires contractors to provide in their environmental management plans the designation of the required impact and preservation reference zones for the primary purposes of ensuring preservation and facilitating monitoring of biological communities impacted by mining activities. Impact reference zones (IRZ) should be designated to be within the seabed claim area actually mined. Preservation reference zones (PRZ) should be designated to include some occurrence of polymetallic nodules in order to be as ecologically similar as possible to the IRZ, and to be removed [isolated] from potential mining impacts. Contractors are required to minimize potential impacts on established preservation zones, and the ISA should consider the potential for impact on established preservation zones in evaluating any application for a mining licence. Contractors are required to include in their environmental management plans specific measures that will maximize the potential for the recovery of biota impacted by their activities in the CCZ. The ISA is in the process of organizing an expert workshop to refine approaches to the size, number and location of PRZs, and their relation to IRZs and APEIs.
Summary: The EU-EIA procedure, as amended in 2014, can be summarised as follows:

1. The developer may request the competent authority to say what should be covered by the EIA information (scoping stage);
2. The developer must provide information on the environmental impact (through an EIA report – see Annex IV);
3. The environmental authorities and the public (and affected Member States) must be informed and consulted;
4. The competent authority decides, taken into consideration the results of consultations.
5. The public is informed of the decision afterwards and can challenge the decision before the courts.

Mandatory vs discretionary EIA: The original EIA Directive (85/337/EEC) is in force since 1985 and applies to a wide range of defined public and private projects, defined in Annexes I and II:

- **Mandatory EIA**: all projects listed in Annex I are considered as having significant effects on the environment and require an EIA (e.g. long-distance railway lines, motorways and express roads, installations for the disposal of hazardous waste, certain waste water treatment plants).
- **Discretion of Member States (screening)**: for projects listed in Annex II, the national authorities have to decide whether an EIA is needed. This is done by the "screening procedure", which determines the effects of projects on the basis of thresholds/criteria or a case by case examination. However, the national authorities must take into account the criteria laid down in Annex III. The projects listed in Annex II are in general those not included in Annex I (railways, roads waste disposal installations, waste water treatment plants), but also other types such as urban development projects or flood-relief works.\(^\text{13}\)
- **Threshold**: focus is on the significance of environmental effects

Major amendments: The initial Directive of 1985 and its subsequent three amendments have been codified by Directive 2011/92/EU of 13 December 2011. Directive 2011/92/EU has in turn been amended in 2014 by **Directive 2014/52/EU**. The following are some of the major amendments:

- The screening process has been amended quite substantially and the changes aim to strengthen the process. Where screening is required for a project (i.e. Annex II projects – those that only require EIA if significant effects on the environment are likely) a Screening Report will need to be submitted.
- Competent authorities will need to provide enhanced explanation of their screening decisions and will have to state which developer-proposed design and mitigation measures

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\(^{13}\) Directive 2014/52/EU, Annex II: 2. EXTRACTIVE INDUSTRY
(a) Quarries, open-cast mining and peat extraction (projects not included in Annex I);
(b) Underground mining;
(c) Extraction of minerals by marine or fluvial dredging (??)
must be included as part of the scheme for a scheme not to be considered as being ‘EIA development’.  

- The selection criteria for Annex II projects at Annex III have been changed, however, and a new Annex IIA has been added self-setting what information developers should provide if seeking a screening opinion. In particular, impacts from waste or use of natural resources would have to be explained.

- In addition, specific consideration will need to be given to impacts of a project on, and its resilience to, climate change, and impacts on cultural heritage and landscape. Information on risks from major accidents or disasters, cumulative effects with any existing or planned projects and any mitigation works which would reduce the environmental impacts would also need to be included.

- The scoping process will remain voluntary for developers but the EIA Report will be required to be based on the scoping opinion where one is requested.

- The Directive inserts clearer requirements for the assessment of the impact of projects in a number of areas including biodiversity, climate change, landscape and disaster risks (which would include, for example, flooding). Whilst these will generally be covered, this is likely to require an increased emphasis in these areas.

- The output of the assessment will now be presented as an ‘EIA Report’, rather than the previous ‘Environmental Statement’. There is also a new requirement for the consent to contain a “reasoned conclusion by the competent authority on the significant effects of the project on the environment”.

- The Directive introduces new monitoring obligations which can apply to both the implementation and management of the project. Where development consent is granted, consideration must be given to whether any appropriate measures to monitor the significant adverse environmental effects of the project are required. The measures must be proportionate to the nature, location and size of the project to ensure they are not unnecessarily onerous. To avoid duplication, existing monitoring arrangements may be relied on, if appropriate.

Time limits: As part of the aim to remove inconsistencies between Member States, the proposals include a minimum public consultation period on the EIA report of 30 days, which is greater than the current UK position. Additionally, authorities must provide screening decisions within 90 days of receipt of the necessary information.

Penalties: The EU has given some bite to the Directive as Member States are required to produce rules to govern any infringements of the Directive. Penalties must be ‘effective, proportionate and dissuasive’ but the nature of penalties to be imposed is at the discretion of the Member States which leaves huge uncertainty for potential developers.

Member States have to apply these rules as from 16 May 2017 at the latest. They also need to communicate to the Commission the national legislation adopted in order to comply with the Directive.

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14 Article 2(4) Directive 2014/52/EU: “(...) Member States may, in exceptional cases, exempt a specific project in whole or in part from the provisions laid down in this Directive.”
Early, open and interactive; systematic; process rather than discrete activity/event.

Use to determine:

- Major issues and impacts that will be important in decision-making and that need to be addressed in the assessment;
- Appropriate time and space boundaries for further studies and assessment;
- Information necessary for decision-making;
- Any gaps in information required, or constraints on methodology;
- Policy and institutional frameworks under which the EIA will be conducted; and
- Significant effects / factors that should be studied in detail.

As a result of the above, used to place limits on information to be gathered and analysed in the EIA, and focuses the approach.

May help define feasible alternatives to proposed action (increasingly recognized as EIA good practice). Consideration of alternatives at an early stage, before plans for location and design are fixed, is likely to be more meaningful. Alternatives should be considered around project demand for resources, resource supply, project activities and processes, schedule and location.

Important to have public input if possible, as well as that of competent authority / other responsible government agencies. Identification of main stakeholders, and definition of their concerns and values, can occur during scoping.

Timing: typically begins after screening, but there may be some overlap between these stages and the scoping process should ideally begin as soon as sufficient information is available.

Output of scoping: Terms of Reference or equivalent document that sets out what EIA will cover, what type of information will be submitted, depth / type of analysis to be carried out, how EIA study should be conducted and managed.

Terms of Reference should be flexible with a working document that can be updated as further information becomes available and as new issues emerge or issues reduce in importance. Significant effects identified during scoping may continue to be re-interpreted throughout the EIA study, decision-making process and project implementation and monitoring.

Identify regulations and guidelines governing the conduct of the EIA and its content; identify any differences or discrepancies between applicable regulations and guidelines (ie, national vs international).

Three steps to the scoping process:

- Compile 'long list' of concerns from information available and stakeholder inputs.
• Derive ‘short list’ of key issues and problem areas based on potential significance and likely importance for decisions-making, by evaluating issues against selected criteria (e.g. potential for mitigation).

• Classify and order key issues into impact categories by reference to policy objectives and scientific concepts (e.g. will impacts exceed health or environmental standards).

For large scale projects with wide ranging and potentially complex effects, it may be necessary / helpful to use impact models or cause-effect frameworks during scoping. These can also help identify long term or secondary impacts of other projects.

http://www.unece.org/env/eia/eia.html

The Espoo (EIA) Convention sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries (see some examples). The Convention was adopted in 1991 and entered into force on 10 September 1997 (see which countries are Parties to the Convention). Applies to UNECE members only. Once first amendment comes into force, will be open to all UN Member States.

Key principles behind Espoo Convention

• Rio Declaration Principle 17: Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

• Rio Declaration Principle 19: States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

Definitions:

• “Impact”: “any effect caused by a proposed activity on the environment including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors.”

General requirements:

• Parties to take all appropriate and effective measures to prevent, reduce and control significant adverse transboundary environmental impacts from proposed activities (art. 2)

• EIA procedure to be establish that permits public participation and preparation of prescribed EIA documentation.

• Party of origin to ensure affected Parties notified of proposed activity likely to cause significant adverse impact and that its public have opportunity to participate

• List of activities for which notification required includes: “Major mining, on-site extraction and processes in metal ores or coal” (listed in Appendix 1)

• Dispute resolution procedure if Parties thinks it should be considered as an “affected Party”

• EIAAs to be done at the project level, and to polices, plans programme to the extent appropriate.

• Notification to affected Parties: as early as possible

• Minimum content for EIA documentation: outlined in Appendix II (art. 4)

• Consultations on documentation to include measures to reduce or eliminate potential SAI.

  o Consultations may relate to: possible alternatives, including the no-action alternative and possible measures to mitigate SAI and to monitor the effects at the expense of the Party of origin (art.5)
• **Post-project analysis**: shall include surveillance of the activities and the determination of any adverse transboundary impact (art. 7)

• **Research programmes**: Parties to give “special consideration to the setting up, or intensification of, specific research programmes aimed at
  
  o Improving existing qualitative and quantitative methods for assessing impacts
  o Achieving a better understanding of cause-effect relationships and their role in integrated environmental management
  o Analysing and monitoring the efficient implementation of decisions on proposed activities
  o Developing methods to stimulate creative approaches in search for environmentally sound alternatives (art.9).

• **Post project analysis objectives** include
  
  o Monitoring compliance with the conditions set out in the authorization or approval of the activities and effectiveness of mitigation measures
  o Review of an impact for proper management and in order to cope with uncertainties
  o Verification of past predictions in order to transfer experience to future activities of the same type (Appendix V).

http://www.cares.nautilusminerals.com/EIA2.aspx?path=1,4,5,13

The development of the ‘Solwara 1’ mining project for polymetallic Seafloor Massive Sulphides (SMS) at a depth of 1600m depth and some 30 km from the coast in the Exclusive Economic Zone (EEZ) of Papua New Guinea (PNG) is the first deep-sea mining project in the world. It has set standards and protocols that may be followed and improved by future deep-sea mining developments, but at present it may be regarded as current Best Practice. Following an Environmental Inception Report submitted to the Government of PNG, and the collection of environmental data through Environmental Impact Assessments (EIAs), an open Environmental Impact Statement (EIS) was published on the web following public hearings, stakeholder consultation and assessment by an independent consultant. The EIS was a requirement of the PNG Environment Act 2000 (Sub-Category 17). The PNG Department of the Environment and Conservation subsequently issued an Environmental Permit for a period of 35 years. A Mining Advisory Board considered the Environmental Permit together with a Technical Development proposal before granting a Mining Lease.

The EIS submitted to the PNG Government related to mining at the seafloor using a Seafloor Mining Tool (SMT), the pumping of the ore up to a Mining Support Vessel (MSV) via a riser and lift system (RALS), the dewatering of the ore, the disposal of the fine tailings, and the barging of the dewatered ore to a facility in PNG. A second EIS will be submitted to the PNG Government for the activities of the processing of the ore on land.

About 130,000 tons of sediment drape lying over the SMS will need to be removed before mining commences. It is anticipated that a further 115,000 tons of waste rock will also have to be disposed of at the site of the mine. The waste rock and sediment drape will be piped downslope from the mine site. It is anticipated the material will be deposited within a radius of 2.3km from the mine site. Some areas may be covered by a layer up to 50cm thick, but most of the deposited material will be much less. The EIS does not state the depth range over which material will be deposited or the benthic communities that might be impacted. However, biomass is considered to be low.

The SMTs are about 8m tall, 17m long and 13m wide, and weigh about 190 tons in water. The ore cut from the seabed will be disaggregated before being transferred to the RALS. A mixture of deep water and ore will be transported to the MSV. The dewatered ore will be transferred to barges. Water separated during the dewatering process will be pumped back to the seafloor and will be used to help power the RALS. The water will contain fine particles (< 8µm) and will be discharged about 25 to 50m above the seabed, at a point close to where it originated, although its temperature may have risen significantly.

As a matter priority Nautilus Minerals recognised the importance of dedicating considerable time to environmental studies as part of its field studies. Considerable knowledge has been generated, which in turn has led to innovative mitigation strategies. Scientific advice has been sought from leading international research organisations, vital for working in such a novel environment where little work has occurred previously. The close association of scientific research with environmental and resource management has set a new standard for all future mining activities in little-known deep-water environments.
In addition, it was important to demonstrate that the release of mineralised minerals during 1) the collection, 2) the initial processing of the ore on the surface vessel and 3) the tailings release would not affect the marine environment, especially fisheries and reefs, upon which the local population depended, particularly in coastal regions. With the discharge of the tailings near the seabed and modelling studies that indicate the plume will not rise beyond a depth of about 1300m, the main effects on the marine environment are believed to relate to normal shipping operations, such as noise, lighting and routine discharges. For the latter potential hazard, standards and protocols are set by the MARPOL 73/78 Convention and the Protection of the Sea (Prevention of Pollution from Ships) Act 1983.

The toxicity of the tailings was tested by standards and protocols used in shallow water and on shallow water organisms. These showed some toxicity effects, but were considered not to be important owing to the proximity of hydrothermal venting to the mine site, with its own cocktail of elements. Water quality standards from shallow water were applied meeting Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) standards. While the concentrations of some metals will be above the 95% threshold set by ANZECC (2000) the required number of dilutions will be achieved within 85m from the point of discharge. Similarly the total suspended solid load will also exceed ANZECC (2000) limits but will achieve the required number of dilutions within 900m of the point of discharge. However, no standards and protocols exist for testing deep-water organisms and their susceptibility to toxic elements, or if the tailings have the same composition as hydrothermal vent fluids.

Assessments of currents throughout the water column were made by Acoustic Doppler Current Profiler (ADCP) instrumented moorings. The data were used for numerical physical oceanographic modelling for assessing the spread of plumes near the seabed.

The repeated sampling of the mining site over a number of years has also set a standard recognising the importance of monitoring how natural processes change with time, in the Solwara 1 case the way in which natural hydrothermal venting changed between being active or inactive, or changed in the intensity, with consequential geochemical and biological changes.

The environmental plan allows for mitigation strategies to assist the recovery of benthic ecosystems. These include the preservation of almost identical communities, in terms of species, abundance, biomass, diversity and community structure, at a locality within 2km upstream. This, it is thought, will allow natural recolonisation of the mined area to occur and will be monitored during mining operations. In addition, active restoration will occur by the translocation of faunal groups from areas about to be mined to those areas were mining is complete. An undertaking is given that faunal refuge areas which have not been mined in the early stages of development will not be used until effective ecosystem recovery has been proven. Translocation of key non-vent fauna, such as corals will also be tested.

Dewatering processes on the surface vessel will remove all particles greater than 8µm. Exposure of the ores to surface temperatures and oxygen will be limited to no more than 12 minutes reducing the potential for geochemical changes. A rise in the temperature water to 13.5°C is likely to occur and the water pumped back to depth will be cooled, although the temperature of the tailings released into the nearbed waters is unknown.
Noise from the seabed mining tools is not considered to be of a nature or of an intensity to cause harm in the marine environment.

A monitoring plan will be submitted to PNG as part of an Environmental Management Plan (EMP) before mining begins. The EMP will monitor and report on compliance with regulatory permits and licenses, including the validation of predicted impacts, the documentation of any unanticipated events and the introduction of additional management measures. Nautilus Minerals will use an environmental management system developed in accordance with the international EMS standard, ISO 14001:2004, as adapted for use in Australia and New Zealand (AS/NZS ISO 14001:2004).
The International Seabed Authority (ISA) in collaboration with the Government of Fiji and the SOPAC Division of the Secretariat of the Pacific Community (SPC) held a Workshop on Environmental Management Needs for Exploration and Exploitation of Deep Sea Minerals, in Nadi, Fiji, from 29 November to 2 December 2011. The outcomes of the workshop were published as part of the ISA Technical Series, including a draft template for an Environmental Impact Assessment (EIA) of deep seabed mining. As part of the progression of mining operations from exploration to exploitation, there is a strong need for detailed environmental assessment, and the development of a formal Environmental Impact Assessment (EIA) process by the ISA.

The EIA template created by the workshop was intended to assist and guide prospective developers planning to carry out mineral exploitation activities, including the creation of a comprehensive Environmental Impact Statement (EIS). It was a first pass at an EIA template which now has been refined to a large extent by the New Zealand EIA template described below. Only a basic outline, therefore, is provided of this ISA document. While contractors to the ISA will refer to Technical Study 10, there is an urgent need for the ISA to update this document building on the New Zealand work and tailoring the document for activities in The Area.

The ISA document lists the main elements required in an EIS, starting with a 15-page Executive Summary explaining the project to non-technical readers. The key elements of an Executive Summary were considered to be:

- A description of the proposed development and its objectives;
- The anticipated bio-physical and socio-economic impacts (direct/indirect, reversible/irreversible)
- Details of remedial actions proposed;
- An account of the benefits to be derived from the project
- Details of the consultation programme undertaken by the applicant, including the degree of public interest
- End-use [decommissioning] plans for the development

One section of the following Introduction should address the purpose of, and justification for, the development, ensuring that the activities proposed are in line with the ISA’s goals and objectives. The details should include,

- The capital cost associated with the development;
- The applicant’s technological expertise and resources;
- Results of the feasibility investigations
- Details of the extent of landowner and/or resource owner support [presumably the sponsoring state], with formal written approval of their consent
- The anticipated lifespan and development phases of the project.

The EIS should also include a ‘Policy, Legal and Administrative Framework’ applicable to the proposed mining operation. It may be separated into four sections, each covering a different aspect of the legal framework:
• Details of how the operation will comply with legislation, regulation and guidelines applying to the management or regulation of mining, and the environment in the Area.
• Details of other legislation, policy and regulations that do not apply specifically to mining or the environment, but which may be relevant to the proposal (e.g. shipping regulations, offshore mining certificates, jurisdictional boundaries).
• Details of relevant international agreements, such as UNCLOS, CBD regulations and UNGA resolutions.
• Details of any other non-legal standards or guidelines that may apply to best practice in the operation, e.g. Equator Principles.

A full account is then required of the many carried stakeholder consultations, particularly any international or jurisdictional consultation obligations, and outcomes of stakeholder surveys and scientific workshops.

The following full description of the development should provide detailed location maps (drawn to scale), site layout, etc. with a description of any supporting activities and infrastructure (e.g. ports, barges, transportation corridors, crew transfers, etc.). This section should provide information on the technologies to be employed, including seabed mining tools, riser lifting devices and surface vessels, referring to the ‘Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for polymetallic nodules in the Area (ISBA/16/LTC/7)’ and include information on methods of exploitation, site selection, alternative scenarios investigated, with relevant diagrams and drawings.

A description of the overall development timetable, from implementation through to decommissioning and closure of operations should include the major phases of the operation, as well as the milestone dates on which relevant tasks are expected to be completed. For reasons of clarity, a Flow chart, Gantt or PERT chart should be used where appropriate. Information provided in this section should include:

• The funding arrangement for proposed activity or if availability of funds is subject to this or other approvals being granted;
• Pre-construction activities;
• Construction schedule, staging, etc.;
• Commissioning and operational schedules;
• Infrastructure development schedule
• Closure schedule.

In a section on the environmental conditions at the mine site, a description of the baseline geological, oceanographic and biological conditions should be given against which mining impacts will be measured and assessed. Special note should be made of any notable characteristics of the site, whether geological, oceanographic or biological, such as hydrothermal venting, seamounts, high-surface productivity, eddies and endemic fauna.

Sufficient information should be provided to enable the ISA to anticipate possible environmental management, monitoring and reporting requirements for an environment permit. Information should reflect the proponent’s environmental policy (Environment Management System) and the translation of the contractor’s management system to meet the ISA requirements during different stages in the project life. This will include details of the contractor’s overall organizational structure and the responsibilities of key personnel. Other sections should include the actions and
commitments that have arisen from the impact minimization and mitigation strategies, details of the monitoring programme during operations, and the closure plan, including decommissioning, continued monitoring and rehabilitation measures, if applicable.


In 2012 the New Zealand Government Ministry for Business, Innovation and Employment funded the New Zealand Institute for Atmospheric and Water Research (NIWA) to develop science-based guidelines for effective environmental management of offshore mineral and hydrocarbon resources. The project included the development of a generic template for Environmental Impact Assessment (EIA), and guidelines for use by any offshore mining or drilling company. The study focussed on the environmental and ecological assessment of impacts, but also included social, economic, and cultural issues. The guidelines built on the EIA template work by the International Seabed Authority (ISA Technical Study No. 10) (see above).

The template provides a detailed list of the various sections that might be included in an EIA. It includes practical advice on form, content and writing style. Where there is uncertainty or a general lack of information, generally typical of deep-water settings, a more cautious approach with adaptive management over time is advised. Such an approach, which is also favoured in Areas Beyond National Jurisdiction (ABNJ), allows activities to commence on a small scale or for a short period so that the effects on the environment can be monitored. The outcomes guide future approaches and consents. However, where substantial financial investment is required to commence mining, such as in the deep sea, the number of steps within an adaptive management approach may have to be more limited.

The New Zealand document addresses different aspects of uncertainty. Following the identification of sources of uncertainty and mitigation to reduce risks, there may be elements of unavoidable risk. This residual uncertainty may be dealt with statistically or by estimating the likelihood of a particular outcome occurring. The case for an uncertain element of the EIA may require the use of predictive models. The NZ document provides some wise observations on how models are described, validated, reviewed and tested against other models, including the validity of the input data used to drive the model. Several cases of how residual uncertainty have been dealt with for deep-sea mining are apparent in the EIS devised by Nautilus Minerals for deep-water mining in PNG waters (described above).

The importance of rigorous baseline studies prior to the submission of an EIS and mining application is stressed in order to address levels of uncertainty when decision makers have to make assessments of the likely effects from mining.

The equipment and procedures adopted in deep-sea mining will be new to many decision makers, and no established standards and protocols are likely to be in place for some time. It will be important, therefore, for detailed descriptions of the technology and its use to be given in an EIS in order for valued judgements to be made. This includes the deployment of structures, pipelines and cables, as well as disturbance to the seafloor environment either by the removal of the substrate, or the smothering of the seabed from plumes, as well as adverse impacts on benthic and pelagic species.

Biological information should amount to more than just species lists. The data provided should allow impacts to be evaluated and compared with the scale of variation expected from natural change.
Measures of the rate of recovery of faunal communities and ecosystem function will be particularly important. Details of genetic diversity, connectivity and food webs may be required. With reference to levels of residual uncertainty described above particular attention should be given to statistical and probability analyses of the data. A comparison of the mining site and reference areas to wider biological communities in the region should be given with reference to the scientific literature.

For assessments of the impacts on the biological environment and their mitigation, a clear understanding of their magnitude, scale, frequency and intensity is required as well as the potential susceptibility of the various components of the biological communities.

Major environmental impacts of deep-sea mining identified by the study include:

**Potential surface impacts**
- increased vessel activities and potential pollution of the surrounding area
- reduction in primary production through shading by discharges
- effects on behaviour of surface/deep-diving mammals and birds through changes in water clarity or noise/lights

**Potential water column impacts**
- plankton/mesopelagic fish mortality
- toxic effects with metal and other contaminants (e.g., ammonia, sulphides, pH reduction) release
- bioaccumulation of toxic metals though the midwater food chain
- sediment plume effects through water column (e.g., visual clarity reduction for feeding)
- potential oxygen depletion at depth
- effects on deep-diving marine mammals
- stimulation of primary production by limiting nutrient release (e.g., nitrogen, iron) in photic depths

**Potential benthic impacts**
- direct physical impact of mining/sampling gear
- smothering/burying of animals by sediment
- clogging of suspension feeders
- toxic effects with metal and other contaminants (e.g., ammonia, sulphides) release
- loss of essential habitat (spawning/nursery grounds)

Spatial management options will likely be a major aspect of how residual impacts can be managed. A key component of any Environmental Management Plan (EMP) will be how any damage to ecosystem structure or function in the mine site can be conserved elsewhere. Options proposed include:
- Closed Areas within the mining or drilling region to protect particularly rare or vulnerable communities
- Preservation Reference Sites to enable monitoring of changes of representative faunal communities in mined versus non-mined areas of the region
- Protected Areas outside the affected region that replicate faunal communities within the mined area, and allow for conservation of the ecosystem structure of the broader area, and perhaps recolonisation of the impacted sites
The mining process will discharge wastes and generate a plume of sediment-laden material with associated chemical contaminants. The report sees the need to estimate “reasonable mixing” rates and dilution using numerical physical oceanographic models. Models are available which provide predictions of concentrations in the near-field and far-field areas of the plume. In many cases previous Standards and Protocols on discharges relate to the offshore drilling operations in the oil and gas sector, and the NIWA report notes that discharges from mining may be rather different.

Apart from environmental effects of mining the NIWA report also considers socio-economic impacts, including fisheries, shipping, tourism, scientific research, areas of historical or cultural value, job creation, sharing of equity from the mining operation.

A comprehensive list of elements that might be included in a monitoring programme are given. This includes ‘Operational Monitoring’ of the rate and volumes discharged, hazardous discharge events and the quantity of mined material removed, and ‘Effects Monitoring’ of physical (e.g., water clarity, sediment deposition), chemical (e.g., contaminants, mixing, water and sediment quality, metal bioaccumulation) and biological (e.g., sentinel species, ecosystem functioning) aspects. The results may be used in modifying procedures through adaptive management. Monitoring programmes are critical to confirm that the effects of the proposed project are as predicted.

Various recommendations are made about the monitoring programme and adaptive management including:

- State the purpose of environmental monitoring, adaptive management and reporting
- Specify the “bottom line” environmental thresholds which are not to be exceeded and the timeframes for compliance
- Establish the environmental baseline prior to operations. (The consent authority should have an approval role to confirm that the environmental baseline has been adequately established, taking into account natural variations in environmental parameters). In complex dynamic environments baseline surveys may be required over a number of seasons to better understand the ranges and timing of natural fluctuations;
- Define who is responsible for undertaking specified actions, particularly monitoring, and a detailed timeline.

The Legal and Technical Commission (LTC) of the International Seabed Authority makes recommendations to ISA Council on the protection of the marine environment (UNCLOS Article 165(e)). This includes ‘Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration of minerals in the Area’, which sets standards and protocols for environmental baseline surveys as part of exploration activities. This document is referred to as the ‘LTC Recommendations’ in the paragraphs below. Apart from being applied to international waters of the Area, the ‘LTC Recommendations’ may also set standards for mining activities within Exclusive Economic Zones (EEZs) of individual States. Contractors to the ISA agree to follow recommendations made by the LTC and any amendments made.

Following the approval of the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (ISBA/6/A/18) in 2000, the Legal and Technical Commission issued guidelines for nodules which were revised in 2010 in the light of increased scientific understanding, such as the use of genetic analyses for taxonomy, GIS mapping of data, and numerical physical oceanographic modelling for assessing possible impacts from operational and discharge plumes. Following the adoption of Regulations on Prospecting and Exploration for Polymetallic Sulphides in 2010 and for Cobalt-rich Ferro-manganese Crusts in the Area in 2012, the ‘LTC Recommendations’ were further amended in 2013 to include all known marine minerals, guided by the outcomes of expert workshops organised by the ISA. The ‘LTC Recommendations’ are reviewed and upgraded at regular intervals.

Approval by the ISA of a plan of work for exploration requires contractors to provide a description of a programme for oceanographic and environmental baseline studies in accordance with any environmental rules, regulations and procedures established by the Authority and recommended by the LTC. Given the technical nature of the ‘LTC Recommendations’ an explanatory commentary has been provided by the LTC as an Annex, which includes a glossary of technical terms. The ‘LTC Recommendations’ include activities for which prior agreement of Environmental Impact Assessments with the Authority is required. This includes all test mining activities.

The ‘LTC Recommendations’ define the biological, chemical, geological and physical measurements to be made and the procedures to be followed to ensure effective protection for the marine environment from harmful effects which may arise from the contractors’ activities. Every plan of work for marine minerals must not only provide environmental baseline data but also include a plan for monitoring to ensure that no serious harm is caused to the marine environment. This includes monitoring during and after testing of collecting systems and equipment.

Information is required from the exploration area to document the natural conditions that exist prior to test mining, to determine natural processes such as dispersion and settling of particles and benthic faunal succession, and to gather data to make accurate environmental impact predictions at the sea-surface, in mid-water and on the seabed.
While the ‘LTC Recommendations’ do not stipulate Best Available Technologies and Best Environmental Practices, it recognises that data of sufficient quality are required for effective Environmental Impact Statements to be submitted, including accurate GIS mapping and the generation of statistically significant results for environmental management, which may depend on sample number, sample size, faunal abundances and locality.

For baseline studies details are provided on parameters that need to be assessed for physical oceanography, geochemistry, chemical oceanography, sediment properties, biological communities, bioturbation (as a measure of ecosystem functioning) and sedimentation. The aims are (i) to compare impacts caused by mining activities with natural changes in the environment, (ii) to evaluate the impacts of deep seabed mining, (iii) to produce an environmental impact assessment as part of an application for the exploitation of marine minerals, including the designation of impact reference zones and preservation reference zones, (iv) to advise on the wider regional management of resources, the conservation of biodiversity and recolonization rates, and (v) to establish procedures demonstrating that no serious harm has occurred to the environment from mining.

For physical oceanographic data are required to be collected to World Ocean Circulation Experiment (WOCE) and Climate Variability and Predictability Research (CLIVAR) standards. The standards detail minimum spacing of measurements, especially in regions of large lateral gradients (e.g. in boundary currents and in proximity to major geomorphologic structures). Detailed advice is given on the number and spacing of current meters on a mooring in relation to the seabed. Data on the water column structure (including temperature and salinity), currents and turbidity are required throughout the water column and especially close to the seabed, in order to assess and monitor operational and tailings-discharge plumes caused by mining equipment and processes. Physical oceanographic models for dispersal studies near the seabed should be used that are accepted by the international ocean modelling community. Standard models are not specified owing to the rapid changes occurring in model design and use, but it is expected that state-of-the-art models are used. A satellite-data analysis is recommended for understanding synoptic-scale surface activity and larger-scale natural events (such as El Nino events).

For geological data Geographic Information System (GIS) regional maps are required with high resolution bathymetry produced at a scale appropriate to the resource and habitat variability. Specific standards for geological and mapping data have not been stipulated. It is possible that with the increasing in mapping databases an international standard will be included when the ‘LTC Recommendations’ are next upgraded. New standards in reporting geological data by contractors are being specified by the ISA LTC and will be adopted in July 2015. These reporting standards, which apply primarily to resource evaluation, may be added to the ‘LTC (environmental) Regulations’.

For chemical oceanography data are required on metals and other elements that may be released during the mining process including chemicals that may be released in the discharge plume following initial processing of minerals at the sea surface. Protocols for chemical parameters are listed in Chapter 23 of the ISA’s ‘Standardization of Environmental Data and Information: Development of Guidelines’ (https://www.isa.org.jm/sites/default/files/files/documents/2001-standards.pdf). Tables 1 and 2 provide standards for sediment chemistry variables. Table 3 lists the minimum requirements of other parameters (phosphate, nitrate, nitrite, silicate, carbonate alkalinity, oxygen, zinc, cadmium, lead, copper, mercury and total organic carbon). Potentially hazardous substances that might be released into the water column during mining should also be assessed. All measurements must be
accurate and in conformance with accepted international scientific standards as detailed by the Climate Variability and Predictability Research (CLIVAR) and GEOTRACES protocols.

The area of biological data is probably the most complex. While the ‘LTC Recommendations’ require that standard practices for the preservation of organisms should be followed, including discrete sampling of sub-habitats into separate sample containers, there is no published international standard to follow. In order to address this gap the ISA has organised two standardisation workshops in the last 2 years, and is in the process of organising a third. The outcomes of these workshops are published on the ISA web pages and it is expected that elements will be used to update the ‘LTC Recommendations’ in 2016. The results of the workshops have been introduced into new requirements for the reporting of biological data in the Annual Reports of the Contractors to the ISA. This includes the requirement to use multiple preservation methods, including preservation in formalin for taxonomic studies; freezing or preservation in 100 per cent ethanol for molecular studies; drying of whole animals and/or selected tissues for stable isotope analyses; and freezing of whole animals and/or selected tissue for trace metal and biochemical analyses.

It is recognised that standardization of methodology and reporting of the results is extremely important. This includes standardization of instruments and equipment, sample collection, treatment and preservation techniques, quality control on board vessels (such as sieving methods for sediment faunal samples), quality control in laboratories (such as sorting and taxonomic identifications), data processing methods, statistical analyses and reporting. The ‘LTC Regulations’ provide detailed information of the key sampling procedures for the different nominal size categories of the benthos and bentho-pelagic (megafauna, macrofauna, meiofauna, scavengers and fauna attached to nodules).

There is a major gap in standards and protocols for pelagic fauna generally.

The ‘LTC Recommendations’ addresses whether individual activities require a prior Environmental Impact Assessment (EIA) to be agreed with the Authority. Normal small scale activities that are exempt are listed. These are small-scale activities typical of normal scientific research cruises. However, where activities increase to the scale of test mining then a full EIA is required. A comprehensive list of information required for assessment by the Authority before test mining is agreed is contained in paragraph 27 of the ‘LTC Recommendations’. In addition, there are some activities, such as dredging, that are treated differently depending on the resource and environment. For nodules dredging of an area up to 10,000 m² on sediments is permitted, but dredging for cobalt crusts on seamounts and for sulphides in and around seamounts and mid ocean ridges requires an EIA for all activities.

The LTC Recommendations’ also foresee the requirement for a wider array of activities to be subjected to an EIA. These include issues relating to bringing large volumes of cold deep-sea water to the sea surface which has the potential to interfere with primary productivity by increasing nutrient levels and decreasing light penetration. The introduction of cold deep water from depth could also alter sea surface temperature locally and release carbon dioxide into the atmosphere. These mining processes may alter food chains, biodiversity, community structure and function, disturb vertical, and other, migrations and lead to changes in the geochemistry of an oxygen-minimum zone, if present.
For all environmental data the ‘LTC Recommendations’ advise that collection and analytical techniques follow best practices, such as those developed by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization and available at world data centres, national oceanographic data centres and the Authority.

The International Seabed Authority (ISA) is holding three workshops to standardize biological sampling procedures and taxonomic identifications. Only then will the work of all contractors across the Clarion Clipperton Zone (CCZ) be able to be compared and be brought together in one database to study biological distributions and connectivity. Two workshops have been held to date, both of which have made recommendations on Standards and Protocols. While the Recommendations are contained at present only in reports on the workshops it is anticipated that the Legal and Technical Commission will include many of these in a revision of the ISA ‘Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area’ (ISBA/19/LTC/8 (2013).

The approval of the environmental management plan (EMP) for the Clarion-Clipperton Zone (CCZ) by the ISA Council (see above) calls for a series of priority actions to implement the EMP. One of those priorities is the standardization of taxonomic work across the CCZ. The task requires that all the contractors of the CCZ participate and share their taxon list at the highest possible taxonomic resolution (taxa level) to establish a sound and defined protocol for reporting biodiversity to ISA.

Megafauna
The megafauna workshop was convened at the Centre for Marine Biodiversity of Senckenberg Institute in Wilhelmshaven, Germany, on June 10-15, 2013. The workshop focused on the evaluation and difficulties in assessing megafaunal biodiversity in the deep sea, specifically at the CCZ.

The workshop recommended that imaging megafauna only during environmental surveys is not a sufficient approach to baseline surveys and monitoring. The workshop strongly endorsed the recommendation of the ISA Legal and Technical Commission (LTC) that megafaunal specimens need to be collected to ensure taxonomic accuracy. Specimens of each morphospecies are required for accurate identifications based on both morphological and genetic characters. In nodule areas, megafauna sampling will require the use of submersibles or Remotely Operated Vehicles (ROVs).

A key element in creating a standardized taxonomy is to have collections of voucher specimens of the species found in each claim area deposited in appropriate collections and facilities, such as national museums. The collections should be freely available and provide easy access for further study.

Standardization should include, inter alia, minimum standards of sampling intensity, the use of taxon-specific preservation methods and the involvement of relevant taxonomic experts. Imaging of specimens in situ / in vivo should be made before collection and where relevant, detailed images of the collected specimens should be made before preservation. Cooperation among contractors should be fostered to ensure good taxonomic inter-calibration.

Modern taxonomic practices rely increasingly on molecular barcoding as well as morphological characters. Sufficiently large samples of key species need to be taken to provide unambiguous data
on the biogeography and connectivity across the CCZ. Different preservation methods may be required for molecular and morphological taxonomic studies.

On-going taxonomic support of contractors could be provided through a clearing house mechanism with appropriate funding. Establishing such a mechanism will assist with the development of taxonomic capacity in accordance with the ISA’s aims to ensure that the standardization work is completed within a reasonable time frame.

Data management procedures and infrastructures must ensure that knowledge and images are available to all parties for further taxonomic classification. Spatial approaches are essential for environmental management and any geo-referenced data must be kept in geo-spatial databases, allowing for biogeographic analyses. A common approach to the analysis of photographic surveys should be devised, with the ISA advising on best practice, perhaps through the organisation of a dedicated workshop.

Biological baseline studies take a long time to be completed owing to the sampling intensity required and the extended time required for taxonomic studies. The workshop participants felt more emphasis by contractors should be made on specific biologically-focused studies.

The development of a collaborative web-based infrastructure would help contractors and taxonomists keep their data continuously updated. Such a website should be produced illustrating the dominant morphotypes found in the CCZ as a first step towards a standardized taxonomy. The ISA would be the most appropriate host for such a website.

The World Registry of Marine Species (WoRMS) should be used to provide the standard use of scientific names of marine species.

**Macrofauna**

The workshop on taxonomic methods and standardisation of macrofauna in the Clarion Clipperton Fracture Zone was held at the East Sea Institute of the Korean Institute for Ocean Science and technology (KIOST), Uljin, Korea, 24-29 November 2014. The workshop recommendations are grouped into four subheadings: a) sampling and processing, b) taxonomic resolution, c) technical cooperation, and; d) data access and availability.

**Sampling and Preservation**

Contractors should undertake biologically-focused sampling cruises. In addition, mixed discipline cruises should allocate sufficient ship berth space for biological teams and sufficient wire time for sampling to allow enough samples for biology. Samples should be taken randomly in the research area during a preliminary survey. From the samples a species cumulative curve can be derived to estimate the number of samples required to provide an adequate assessment of the number of species in the mining area. Epibenthic sledge device should be included as part of baseline sampling, especially for assessing connectivity across the CCZ.

The workshop noted that box core samples for biology should not be divided into subsamples for other disciplines, owing to the low abundances typical for macrofauna in the CCZ. Contractors were urged to use the LTC guidelines in the processing of box core samples and that any sample subdivision or processing step should be included in the contractor’s Annual Report to the ISA.
Contractors should be urged to take samples for molecular taxonomic analyses to support greater accuracy in biodiversity and ecological assessments. Contractors should deposit all identified material (including molecular samples) in an internationally recognized museum or collections facility. The material should be freely accessible for study and be able to be sent on loan to researchers. The need for material to be archived in an appropriate collections facility should be specified in the contractor’s plan of work and the contractor should identify in which facility their material will be deposited. How the transfer of taxonomic material to the collections facility will be financed should also be included in the plan of work.

**Taxonomic resolution**

Specimens must be identified to species level and follow the World Registry of Marine Species (www.marinespecies.org).

**Technical co-operation**

A technical co-operation framework should be established to support training, visiting scientists programmes, joint industry/academic partnerships and taxonomic consistency and quality control. A taxonomic clearing house mechanism, advising on world experts willing to undertake taxonomic work on specific faunal groups, should be created to support contractors seeking taxonomic expertise. Inter-calibration workshops should be organised to bring together 1) contractors working in the various regions of the CCZ and 2) taxonomists to review and assess collections made in different contract areas. The ISA should create an expert panel to assist the Authority in the assessment and validation of species level studies as part of the annual data returns.

**Data access and availability**

The development of the Authority’s database is strongly supported. Researchers and contractors are encouraged to work with the Authority to provide expertise in developing the taxonomic framework. Taxonomists working on material from the CCZ should publish their data in recognized scientific journals as soon as practical. The publication of Special Volumes in appropriate scientific journals, such as ZooKeys (http://www.pensoft.net/journals/zookeys/) and Zootaxa (http://www.mapress.com/zootaxa/), should be coordinated to enable taxonomists to describe and publish descriptions of the fauna of the CCZ quickly and as soon as sufficient material is available.
Annex 33. EU Marine Strategic Framework Directive and other directives
For Descriptor 1- Biological diversity, some considerations regarding monitoring and research needs are stated on the technical documents:

Synergies and cooperation. Art. 5.2 of the Directive requires regional cooperation. Further synergies with existing monitoring, other policies and research programmes are recommended.

Assessment and monitoring programme. A pragmatic risk-based and synergistic approach is recommended. The following main questions are to be addressed:

- What is the current state of biological diversity?
- What is the deviation between observed and target conditions?
- What is the direction of deviation from target conditions, and the speed of change?
- What are the causes of observed changes in biological diversity?

Preparatory tasks:
- Task 1: Collate environmental data to support assessment;
- Task 2: Identify biodiversity components present in region or sub-region;
- Task 3: Define ecologically-relevant assessment areas;
- Task 4: Define reference state (condition);
- Task 5: Define targets.

Monitoring phases:
- Phase 1: Prioritising where to monitor in relation to the location and types of human activities and their associated pressures on and risks to biodiversity;
- Phase 2: Prioritising which biodiversity components and criteria to monitor, based on an assessment of risk to targets;
- Phase 3: Selecting indicators to inform the state of the selected of the selected biodiversity components in relation to the targets set; Phase 4: Collecting the evidence (monitoring) needed to support the assessment of state and trends;
- Phase 5: Assessment of the evidence to draw conclusions the proximity to GES, direction and rate of change and progress towards (or away from) GES. Reporting of assessments.
- Phase 6: Developing a Programme of Measures to define appropriate remedial actions;
- Phase 7: Adaptive management, adjusting the spatial and temporal intensity of a) the monitoring programme and b) the programme of measures.

One of the biggest challenges is to extend monitoring off-shore, i.e. to the deep-sea regions. In the MSFD there are no specifications for monitoring frequency. Since the cycle of assessment, determination of GES, target setting, monitoring and establishment of measures should be reviewed and updated every six years the provided data should allow representative assessments at that timescale. While for some indicators therefore the minimum monitoring frequency should not be less than every 6 years, others are based on trend assessments and monitoring of change, requiring therefore higher data acquisition frequencies. Guidelines for the minimum operational (for water bodies at risk) monitoring frequency for coastal waters varied from every 1 months to every 6 years with the quality monitoring frequency for macro invertebrates pinpointed at 3 years. And since the
choice of MSFD monitoring frequency should be parameter and indicator specific a higher monitoring frequency than 6 years should be taken into consideration.
Annex 34. IMO and UNEP: International Assessment of Marine and Riverine Disposal of Mine Tailings (2013)
(Best Management Practices)

Technical and Engineering:
• no soluble toxic compounds should be contained in tailings;
• flotation agents and flocculation compounds should be easily degradable;
• minimize use of chemicals in ore separation process;
• develop cyanide management plan (if using) to minimize use and remove via treatment;
• reduce entrapment of air within tailings slurry;
• slurry should be minimum 30% solids;
• density of slurry should exceed that of disposal location to ensure the tailings sink;
• flocculants may be used to control fine particles;
• disposal outfall location should be in low energy environment, with a slope to prevent build up;
• discharge location should be below the pycnocline and the euphotic zone.

Disposal Site Considerations:
• suitable bathymetry and physical oceanography required to prevent dispersion (ie steep submarine slopes, canyons, natural channels etc)
• avoid important spawning grounds, or commercial / artisanal / subsistence fishing grounds;
• seabed type in depositional area - should be soft-sediment;
• anoxic conditions at disposal location preferable;
• absence of upwelling, seasonal overturning, currents.

Other:
• Tailings Management Plan should be produced, documenting entire process: design, operation, closure and rehabilitation.

Specific guidelines and standards for marine tailings disposal in Philippines (DENR Memorandum Order No. 99-32, 1999). Marine tailings may be considered under certain strict conditions, where it is planned for tailings to settle in:
• areas of very low biological productivity, at depths of >100m; or
• areas subject to high existing rates of sedimentation;
• provided that in both cases the dissolved constituents of the tailings, beyond the immediate mixing zone, conform with relevant water quality criteria.

EC provides guidance on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities (2009). Applicable BAT is to:
• apply life cycle management approach;
• reduce reagent consumption;
• monitor water around all tailings disposal areas.

Best closure results will be achieved when plans are developed for the site closure at the design stage of the project.
Annex 35. IMO Guidelines for Ballast Water Management Plans

For a plan to be effective it must be carefully tailored to the particular ship for which it is intended.

The plan is required to be onboard the ship and available to guide personnel in safe operation of the Ballast Water Management system employed on a particular ship. Effective planning ensures that the necessary actions are taken in a structured, logical, and safe manner.

The plan must be: realistic, practical and easy to use; understood by those personnel required to use it; evaluated, reviewed and updated as necessary; consistent with the operational requirements of the project; available in a working language for the personnel required to use it.

Inclusion of extensive background information should be avoided (or kept to annexes);

The plan should be readily available for external verification / auditing purposes.

Regular review of the plan by the owner, operator, or master should be conducted to ensure that the information contained is accurate and updated. A feedback system should be employed which will allow quick capture of changing information and incorporation of it into the plan.

The plan should include:

- Safety procedures for personnel implementing the plan;
- A detailed description of the actions to be taken to implement the plan;
- Designate responsibility for ensuring that the plan is properly implemented;
- Reporting requirements associated with activities (e.g. what documentation needs to be maintained, what needs to be made internally / publicly available);
- Foreword explaining the need for the plan and the procedures described;
- Details of the applicability of the plan (i.e. what operations it covers, what ship);
- Provisions for training and familiarisation of personnel with the plan.

Garbage management plan required for all ships of ≥100 gross tonnage; all ships certified to carry ≥15 persons; and all fixed or floating platforms (and must be carried on ship).

Garbage Record Book must be carried on all ships of ≥400 gross tonnage; all ships certified to carry ≥15 persons engaged in voyages to ports / offshore terminals of other parties; and all fixed or floating platforms.

Placards notifying crew and passengers of ship’s disposal requirements in relation to MARPOL Annex V (regulations 3, 4, 5 & 6) are required for every ship of ≥12 m in length overall, and on all fixed or floating platforms.

Garbage management plan should detail the specific ship’s equipment, arrangements and procedures for the handling of garbage - procedures for minimizing, collecting, storing, processing and disposing of garbage, including the use of the equipment on board.

Plan should designate persons responsible for implementing the plan.

Plan should align with revised MARPOL Annex V and IMO guidelines for the implementation of MARPOL Annex V; also reference ISO 21070 (Standard for the Management and handling of shipboard garbage).

Plan will include procedures for collecting garbage, processing garbage, storing garbage and discharging garbage (eg equipment and personnel, locations, receptacles, handling procedures, training requirements).

Plan should include measures to encourage the reduction of garbage at source (ie reduced use of packaging at suppliers), and to enable the re-use of waste onboard the ship and recycling of waste at port facilities.

Each component of a ship’s garbage should be evaluated separately to determine the best management practice for that type of garbage.
Annex 37. ISO14001: 2004

It is normally desirable to achieve external certification to an acknowledged management system standard (such as ISO 14001 for example) to provide external verification that the building blocks of an accepted management system are in place. External verification is required in order to renew accreditation. This occurs annually in most cases. In addition there are internal reporting requirements of:

- the results of internal audits
- an evaluation of compliance with legal requirements and other requirements associated with the organisation
- communications from external interested parties including complaints
- environmental performance
- achievement of objectives and targets
- corrective and preventative actions
- follow up actions from previous management review meetings
- changing circumstances (e.g. legal, new developments, changes to activities etc.)
- recommendations for improvements and changes to the EMS (including policy/ objectives etc.)
Annex 38. Eco-Management and Audit Scheme (EMAS)

The ISO 14001 Environmental Management System requirements are an integral part of EMAS. However, EMAS takes into account additional elements to support organisations that continuously improve their environmental performance. Specifically EMAS adds value through:

- stricter requirements on the measurement and evaluation of environmental performance against objectives and targets, and the continuous improvement of environmental performance.
- assurance of legal security compliance with environmental legislation through government supervision.
- the stronger involvement of employees
- the creation of environmental core indicators to allow multi-annual comparability, within and between organisations.
- the availability of information to the general public through a validated environmental statement.
- ensuring the management system is registered by a public authority after verification and by an accredited/licensed environmental verifier
Annex 39. OSPAR Recommendation 2003/5

The purpose of the OSPAR Recommendation is to promote the use and implementation by the offshore oil and gas industry of environmental management systems that also include elements for auditing and reporting. Contracting Parties to OSPAR were required to promote and encourage the use by operators within their jurisdiction of management systems that are in accordance with the principles of internationally recognised standards, such as ISO 14001. Verification that this is the case should be carried out by bodies possessing recognised competence in the area and not connected with the operator. The goal of the Recommendation was that by the end of 2005 all operators within Contracting Parties’ jurisdiction in the maritime area would have such management systems in place.

Briefly, the OSPAR Recommendation should promote the use and implementation of Environmental Management Systems within the offshore industry. ISO 14001:2004 and EMAS contain elements required by this Recommendation.

The EMS should:

- aim to achieve the environmental goals of the prevention and elimination of pollution from offshore sources and of the protection and conservation of the maritime area against other adverse effects of offshore activities; and maintain continual improvement in environmental performance
- be implemented at a strategic level and integrated into corporate plans and policies
- identify the organisation’s impacts on the environment and set clear objectives and targets to improve its management of these aspects and the organisation’s overall environmental performance
- be designed to deliver and manage compliance with environmental laws and regulations on an ongoing basis, and to quickly initiate corrective and preventative action in cases of legal non-compliance
- deliver good resource management
- incorporate assured performance metrics that demonstrate the above and can be communicated in a transparent manner

Elements covered by the EMS include: environmental policy; environmental aspects; legal and other requirements; objectives, targets and programmes; resources, roles, responsibility and authority; competence training, and responsibility and authority awareness; communication; documentation; control of documents; operational control; emergency preparedness and response; monitoring and measurement; evaluation of compliance; non-conformity, corrective action and preventative action; control of records; internal audit

Operators undertaking offshore activities must prepare a publically available Annual Statement.
IHC Merwede BV ("IHC") is a company which develops, builds and maintains innovative dredgers and ships for the world dredging, wet mining and offshore markets. In recent years IHC has been expanding its range of products and services by applying its technological knowledge in dredging to deep-sea mining. IHC aims to expand its position as the market leader in dredging and wet mining in the offshore market through strategic actions for growth, internationalisation, product and process development and collaboration. In doing so IHC’s corporate social responsibility (CSR) strategy seeks to balance its responsibilities between profit, people and the planet. It is based on sustainable entrepreneurship, social responsibility and environmental accountability.

In terms of environmental accountability IHC aims to reduce the environmental impact of its products, services and production processes. The group strives to contribute to a better environment, both now and in the future. IHC’s environmental accountability encompasses sustainable product development. It makes use of “green” technologies to reduce the environmental impact of its products over the entire life cycle in terms of energy consumption, emissions, (underwater) noise, turbidity, spillage and waste. IHC’s is committed to compliance with environmental laws and regulations. It also considers social and environmental factors when purchasing products and services from suppliers.

The IHC Code of Conduct (hereinafter the “Code”) provides guidelines for the ethical conduct of its business to which IHC’s own organisation, its suppliers and third parties engaged by IHC must adhere. The Code applies to all of IHC’s directors and employees and all third parties who develop activities for or on behalf of IHC. All of them must comply with the Code and the guidelines and rules that are based on it. Infringement of the Code could result in disciplinary measures, including dismissal.

The Code has 6 major elements applying to 1) employees, 2) business integrity, 3) human rights and society, 4) the environment, 5) the supply chain and 6) data privacy.

**Employees**

- IHC tries to make the working environment as attractive as possible, where employees are encouraged to communicate with each other effectively and where involvement and responsibility are promoted as core values.
- IHC makes every effort to offer its employees continued opportunities for personal development, together with training for the areas in which they work.
- IHC is keen to protect the health of all of its employees, including temporary employees, and more particularly to prevent industrial accidents and injury.
- IHC recognises and respects the freedom of employees to organise their own association.
- Each employee has equal chances and opportunities and will be treated equally, irrespective of race, gender, nationality, age or religion.
- Salaries and working hours will conform to local legislation and prevailing industry standards.
- IHC will process personal data in conformity with the provisions of the Dutch Personal Data Protection Act.
**Business Integrity**

- IHC is committed to honesty and integrity in all aspects of its business. Bribery is unacceptable to IHC.
- IHC complies with the provisions of international embargoes imposed and/or approved by the European Union and/or the United Nations.
- Employees are not permitted to have a financial interest, direct or indirect, in an IHC supplier or IHC competitor, other than a financial interest in a listed company.
- IHC will not make payments or give gifts to individual politicians, political parties or organisations. All business transactions performed in IHC’s name must be recorded accurately and honestly in the company accounts.
- IHC makes every effort to ensure that entries in the accounts of the IHC units faithfully reflect all transactions and also their financial position.
- IHC is an advocate of the principles of free enterprise and fair competition. IHC will compete vigorously but fairly, on the basic premise that this competition will always remain within the framework of the relevant competition legislation.

**Human Rights and Society**

- Human rights, as they are set out in the Universal Declaration of Human Rights, will be respected.
- Under no circumstances will IHC ever use forced labour or child labour.
- IHC will make every effort to participate in relevant social projects and initiatives.
- IHC will make every effort to encourage employment at local level.

**Environment**

- IHC supports any environment-enhancing initiatives that are within its capacity and in line with its objectives.
- IHC will comply, at a minimum, with relevant statutory environmental provisions and regulations.
- The prevention or restriction, insofar as possible, of soil, water, air and noise pollution, waste substances and use of hazardous materials are key elements in IHC’s policy. If possible, waste will be separated and processed. Water and energy will always be used as efficiently as possible.
- IHC is keen to develop the environmental awareness of its employees and others working on IHC’s premises in such a way that everyone supports caring for the environment.

**Supply Chain**

- Suppliers will be selected on the basis of commercial considerations. Relevant suppliers will be offered an equal opportunity to bid for contracts. All potential suppliers will be provided with the same information.
- Suppliers will be selected on the basis of objective criteria and not based on personal preference.
• IHC will not do business with suppliers which do not adhere to the values expressed by IHC in this Code.
• IHC buyers must maintain a positive relationship with suppliers, which will include being mindful of the supplier’s interests. IHC buyers will observe the IHC Procurement Code.

**Data Privacy**

• IHC has the obligation to protect personal data the company gathers belonging to employees, customers, suppliers or any other third party.
• IHC recognizes the importance of protecting personal data and has committed itself to the IHC Privacy Regulations. IHC will only use personal data for specific purposes and in accordance with the terms of the Privacy Regulations and the privacy legislation.
Nautilus Minerals is a business focussed on seabed natural resources. As part of the company’s pioneering work in deep-sea mining the company has developed a specific programme for corporate social responsibility (CSR), Nautilus CARES. Its first activity is within the EEZ of Papua New Guinea (PNG). In addition, the mine site (named Solwara 1) is the first mine in deep water and in an area in which very little environmental information was available at the start of exploration activities. This required a particular focus in setting best practice social, environmental, safety and health standards.

The Solwara 1 Project is rather different from traditional (land) mining projects in PNG. The deep-sea mining activity will occur at depths of 1600m, so communities or landowners are affected directly. However, the mine site is some 30km offshore and so is of concern to PNG communities. The company as part of its CSR, therefore, engaged with a number of villages and towns within PNG determined in consultation with national and provincial governments, using brochures in English and the local language Tok Pisin. The aims of the local consultations were:

- To ensure that stakeholders, government departments and communities adjacent to Solwara 1 were properly informed about the Project
- To provide a structure to allow all stakeholders to provide input to the environmental assessment process
- To ensure consideration is given to the valid concerns and interests of stakeholders
- To incorporate concerns into mitigation plans as practicable
- To ensure that the applicable regulatory requirements related to public consultation and disclosure are met

Concerns were expressed about the health of coral reefs and fish stocks and addressed through designing a mining system that will limit impacts in surface waters to the presence of a vessel and transport barges.

Working in a developing nation has put particular importance on education and training as part of the CSR plan. Nautilus Minerals is engaged in a program to build skill and capacity in Papua New Guinea by employing and providing vocational training for geologists, geophysicists and environmental scientists. Apart from the advantages to the host nation the company will benefit from a local experience workforce. A number of other initiatives are also being undertaken with the Provincial Governments to identify community priorities for improving the quality of life through the provision of health and education services.

In order to obtain an environmental permit Nautilus Minerals produced an initial Environmental Inception Report, followed by Environmental Impact Assessments (EIAs) for exploration activities and ending with a full Environmental Impact Statement (EIS), all reported openly on the Nautilus CARES web pages and in public documents distributed to national and provincial government departments throughout PNG. The Inception Report incorporated inputs from PNG-based and
international NGOs, scientists, consultants, environmentalists and world-renowned experts in the field of marine and social science. The EIS enabled engineering, cost, environmental, commercial implications to be assessed by Nautilus, the public and PNG government agencies.
Annex 42. IPIECA guide to Environment Health and Safety Management Systems

IPIECA (International Petroleum Industry Environmental Conservation Association)
(The full title has not been used since 2002)

Most HSE management systems are a collection of a number of individual systems and practices that are managed together within an overall framework. The individual systems and the overall framework consist of a 'Plan-Implement-Measure-Adjust' cycles (or similar, e.g. plan-check-do):

- Planning: developing, identifying and prioritising needs, and establishing objectives and targets.
- Implementing: applying the right resources, and demonstrating leadership, commitment and support, as well as ensuring that an appropriate organisational structure is in place.
- Measuring: identifying the key performance indicators (KPIs), and setting up the required audit and review processes.
- Adjusting: reviewing EHS results and findings, and adjusting accordingly.

The individual systems (e.g. legal compliance, safety management) will vary from business to business and facility to facility. However, to be effective, these individual systems should possess and be documented as possessing, the following five basic ‘characteristics’:

- Scope to define the system’s boundaries and identify interfaces with other systems, organisations and facilities, with objectives that define the system’s purpose and expected outcomes:
- Processes that address the steps that describe what the system does and how it functions, and procedures that address the key tasks required by a process;
- Responsible and accountable resources in terms of such matters as how approvals are authorised, experience and training requirements in regard to both implementation and execution of the management system.
- Verification and measurement for the system to be checked to see whether it is functioning as designed and achieving its desired purpose;
- Feedback from assessments, and from verification and measurement activities and improvement mechanisms to help ensure that actions are taken to continuously improve the system.

IPIECA’s template for an HSE management system is made up of 11 elements:

- Policy and leadership
- Continuous improvement
- Safety and health
- Risk management
- Incident reporting and investigation
- Crisis preparedness
- Environmental protection
- Product stewardship
- Training
- Community relations
• Legal requirements
Annex 43. Oil and Gas UK guide to basic requirements of an Environmental Management System

Oil and Gas UK
(formerly UK Offshore Operators Association, UKOOA)

Oil and Gas UK provides information on the basic requirements of an EMS in the more specific context of the UK Continental Shelf:

• Develop an environmental policy statement;
• Identify environmental aspects, including highlighting those which are significant;
• Identify relevant legislation and determine how requirements apply to the company’s environmental aspects;
• Develop environmental objectives and targets;
• Ensure that there are available resources to comply with the requirements of the EMS;
• Ensure that personnel have the relevant training or experience, particularly in areas where significant environmental aspects have been identified;
• Identify potential emergency situations and accidents which may have environmental consequences and develop response and mitigation procedures;
• Monitor and measure key characteristics of company operations that could have significant environmental impacts;
• Evaluate compliance with applicable legal requirements and;
• Undertake audits against the requirements of the standard and the requirements of the EMS.